



Building the 1/12th Scale Replica of the
1966 USAC Championship Winning Sprint Car
by: Randy Derr



This project is dedicated to Clarence "Mutt" Anderson.

Thank you for your interest and assistance. May you rest in peace.

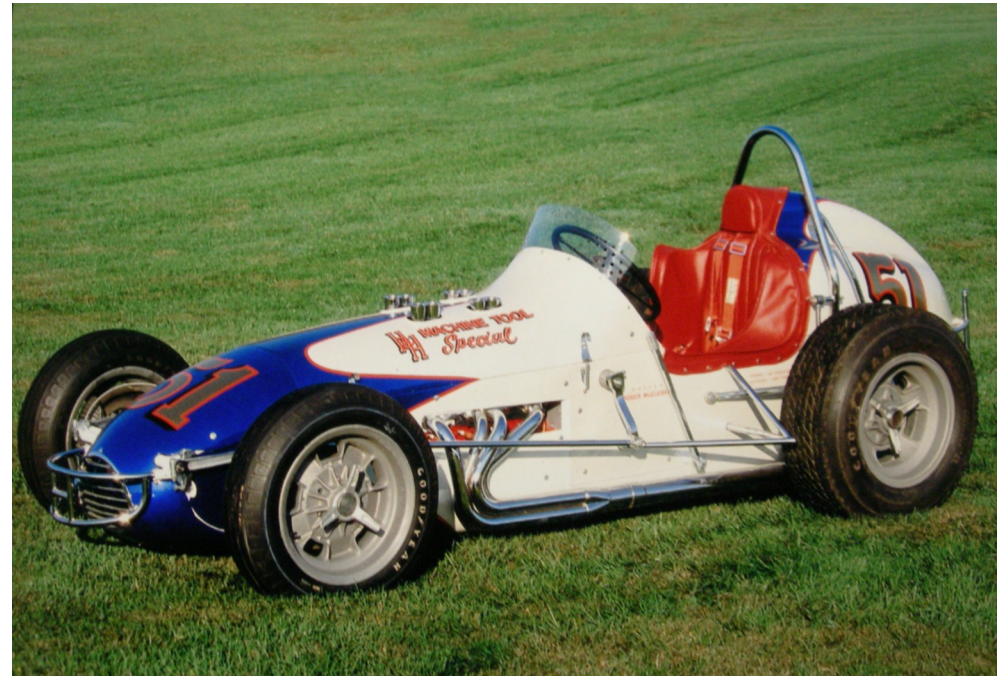
I would be remiss if I did not also thank Mutt's sons, Phil and Mike and his grandson, Kirk. Without their invaluable help, building this model would not have been possible. May it serve as a small reminder of Mutt's many racing accomplishments.



In the summer of 2005, our local model club held a meeting in the race shop of a sprint car racing legend; Clarence "Mutt" Anderson. Mr. Anderson raced sprints as a driver beginning in the 30's and continued in the sport through the 70's as a owner and crew chief. At the race shop were restored versions of three of his race cars: a 1937 Dreyer sprinter driven by Everret Saylor, a 1948 Kurtis Kraft midget driven by Mike Nazaruk and a Jud Phillips-built sprint car driven by Roger McCluskey to the 1966 USAC Championship title.

This last one really caught my eye. It was from the racing era before roll cages became the norm and in its immaculate pearl white and candy blue paint with gold leaf numbers, it harkened back to the days of men risking it all for a shot at racing glory. A car like this one could take a talented driver all the way to the USAC title and even a chance to race at the Indy 500. I knew I had to build it, and it would need to be done in large scale.

I had found my next major model project.



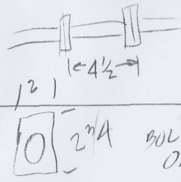


I took a few photos of the car that day and then started planning the project carefully. As with all of my projects, that meant gathering enough reference material to be able to accurately replicate the car. In this case, I had an enormous advantage, as the restored car was located a mere 15 minutes from my home. Adding to my good fortune was the openness the Anderson family provided to see this project come to fruition. After contacting Mr. Anderson and explaining my plans I was able to return to the race shop and obtain additional photos, take measurements and make sketches of major components to guide the build process. I eventually compiled a reference book containing over 400 photos and dozens of drawings to serve as my data base for this project.

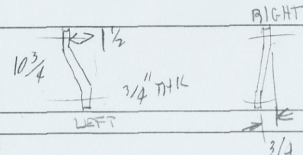


1961 Jud Phillips Sprint Car

Frame			
Tube sizes	1.375		
Mounting brackets	0.125 THK	0.167	0.273
Firewall			
Misc.			



Torsion bars			
Front	Bars	1" ϕ	
	Mounts		
	Links		
	Adjuster		



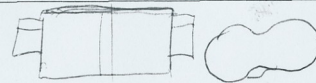
Rear	Bars	1" ϕ	
	Mounts		
	Links		
	Adjuster		

Front Axle			
Radius Rods	3/8 ϕ	1/2" BOLTS	L-12 3/4 ϕ TO ϕ R-15" ϕ TO ϕ 48 3/4 DRAG LINK LENGTH
Steering Linkage	3/8 ϕ		
Shocks and mounts	0.120 THK MOUNTS	5/8 ϕ ALTS	

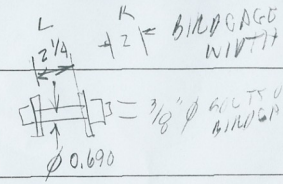
Front Wheels/Tires			
Wheel diameter	17 3/4		
Wheel widths	7 W		
Tire diameter	26 1/2"		
Tire widths	7 W		

5" BOLT CIRCLE ON DRIVE PINS
0.61" ϕ DRIVE PINS

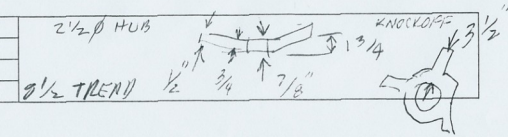
Engine			
Block/mounts			
Intake manifold			
	stacks	1.00	6 1/2" TALL
	injectors	0.440" BLOCALS	
	throttle linkage		
	fuel block/lines		
	gas pedal		
Cooling System			
	Water pump		
	Radiator		
	Hoses/lines		
Fuel System			
	Tank		
	Filler/Vent		
	Lines		
	Valve		
Oiling System			
	Tank	4.5 x 6.75 x 15.75	EST
	Pump	9 x 3 1/2	
	Lines	3/4" ϕ	
	Breathers	2.00 x 1.5 TALL	
	Cooler	NONE	
Exhaust			
	Headers	1 3/4" ϕ	
	Pipes		
Ignition			
	Magneto		
	Plug wires	0.278" ϕ	
	Plugs	"SMALL"	



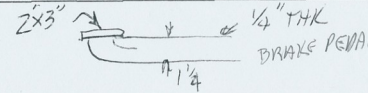
Rear Axle			
Housing	9" BLOC		
Birdcages	0.35" THK		
Radius Rods	L-20 1/2 R-18" ϕ TO ϕ		
Shocks and mounts			
Jacobs ladder	0.230 THK		



Rear Wheels/Tires			
Wheel diameter	17 3/4 ϕ		
Wheel widths	L-11" R-10"		
Tire diameter	L-29 R-29		
Tire widths	L-11 1/2 R-11"		



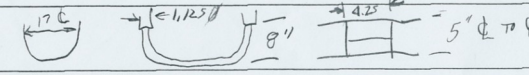
Brakes			
M/C			
Pedal			
Front	Rotors	12" ϕ 0.400 THK	
	Calipers		
	Mounts		
	Lines	0.313 ϕ FITTINGS 0.1560 ACROSS FLATS	



Rear	Rotors	L 3/8 THK R-0.330	380 36" CIRC - 11.5"
	Calipers		
	Mounts		
	Lines		

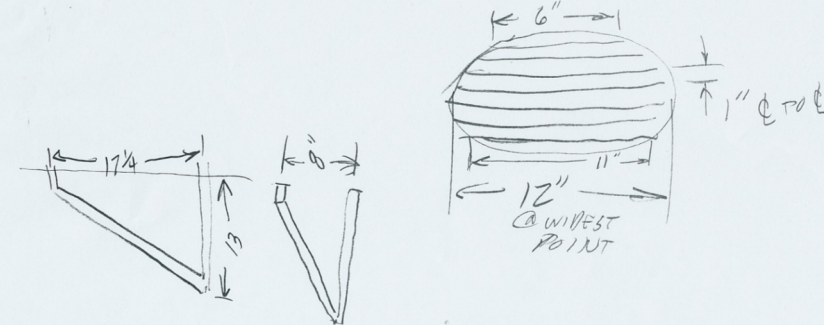
Roll cage			
Roll bar	1.375		
Braces	0.885		
Mounts	1.629		

Front Bumper			
Front Grill	0.885		
Dirt Shield			

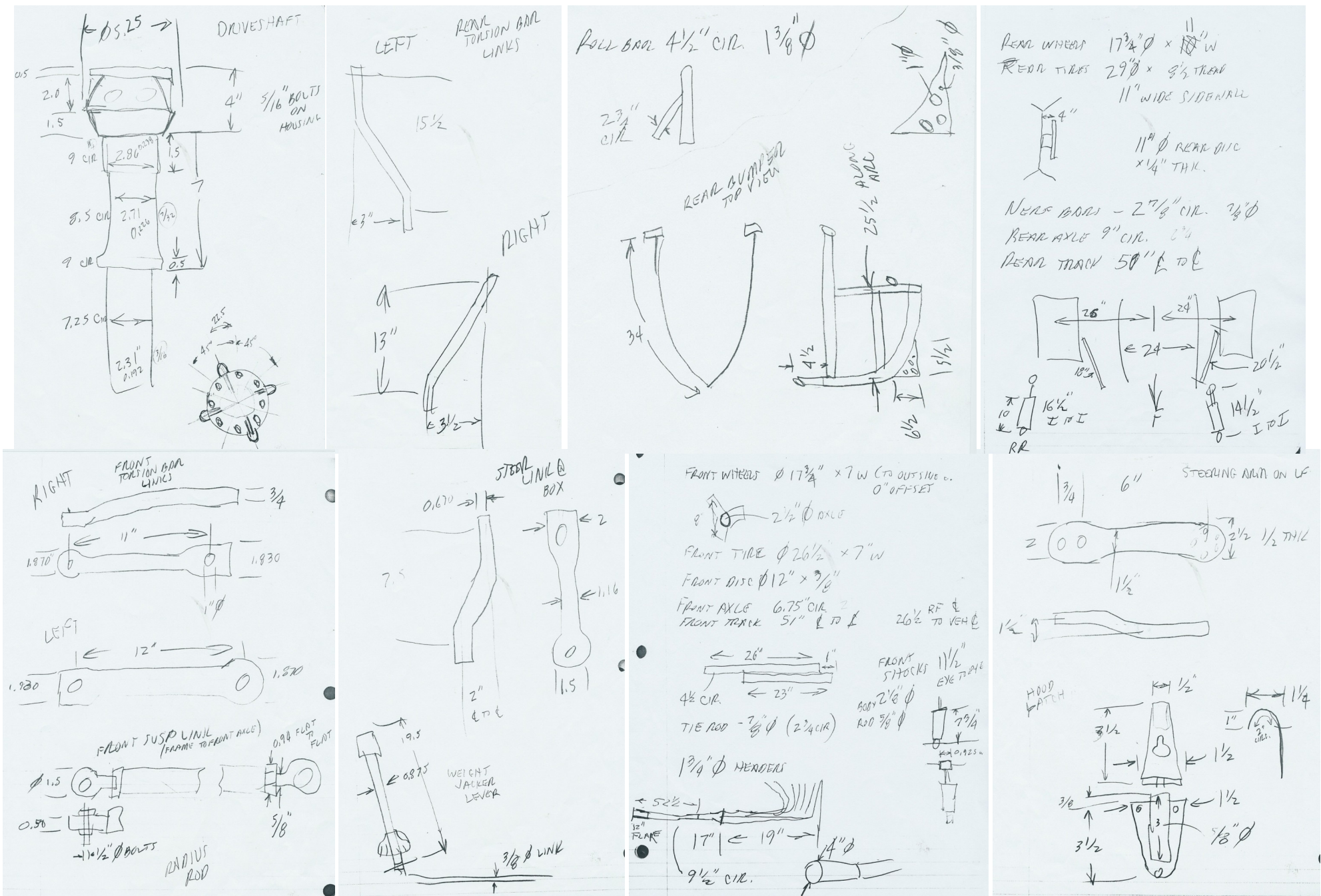


Side Nerf Bars			
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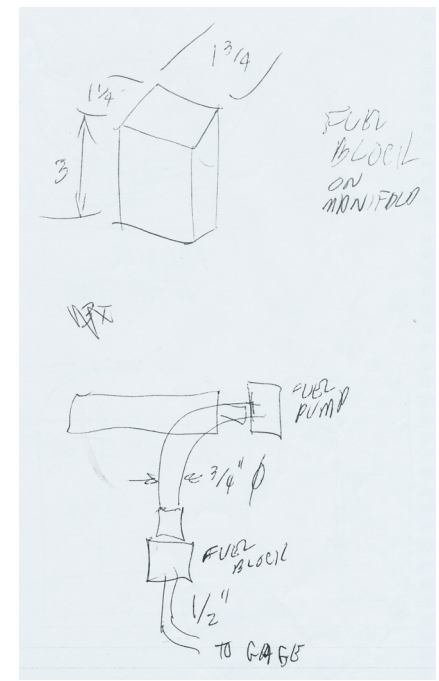
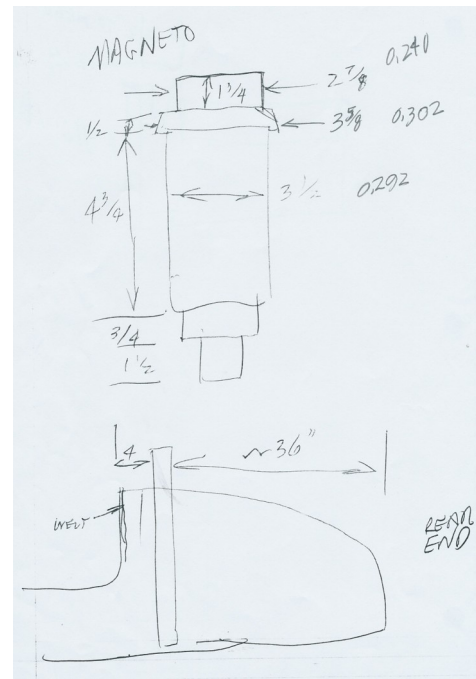
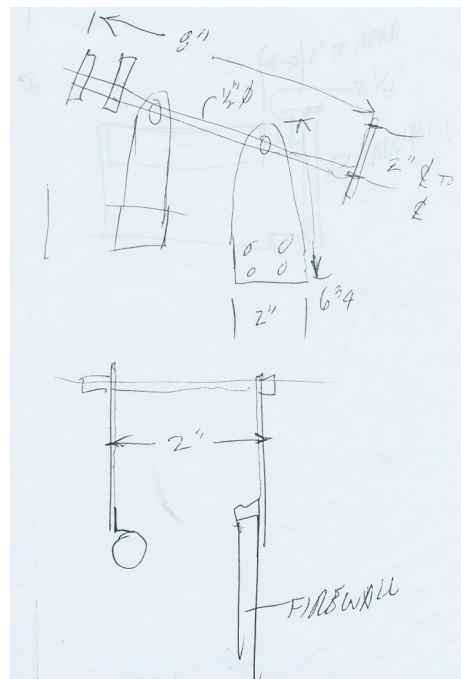
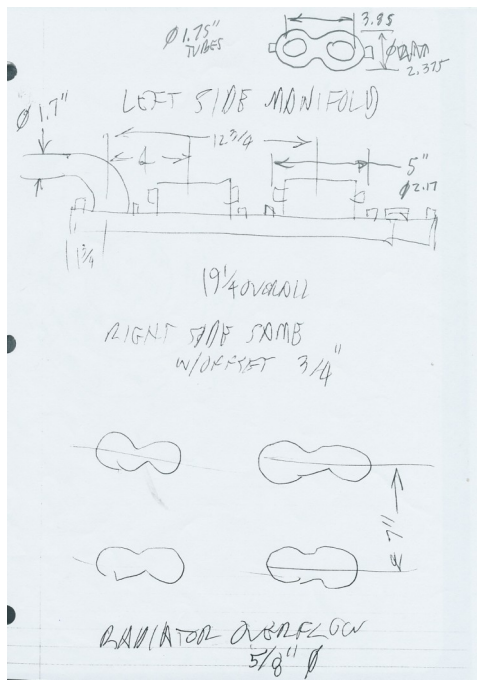
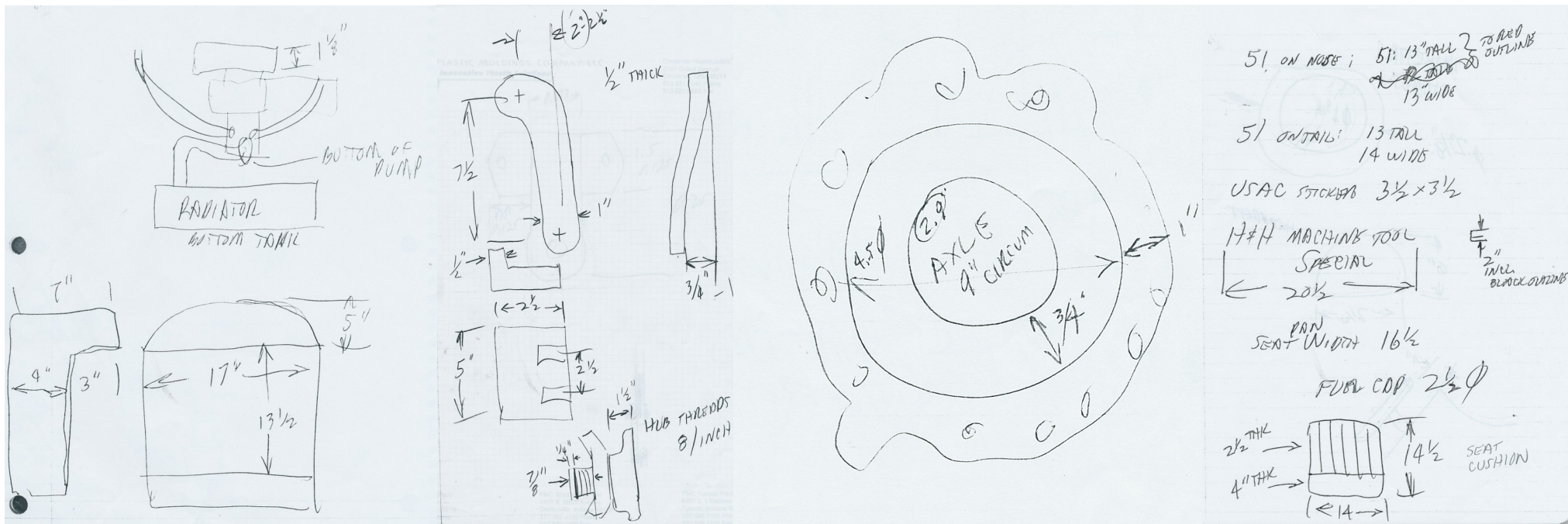
Rear Bumper			
Push bar detail			



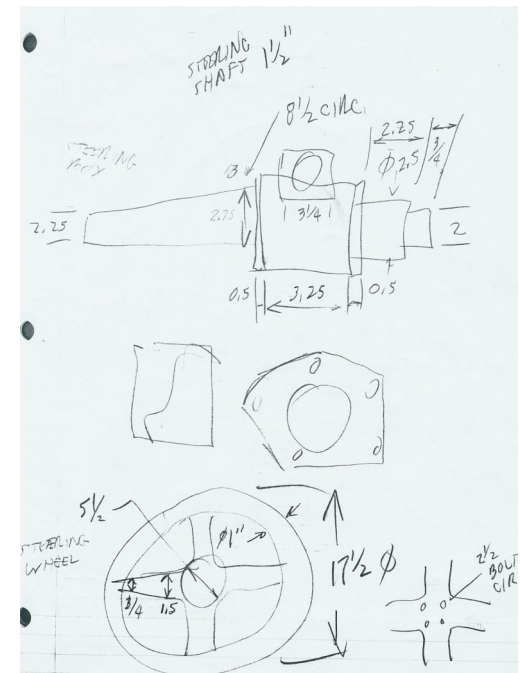
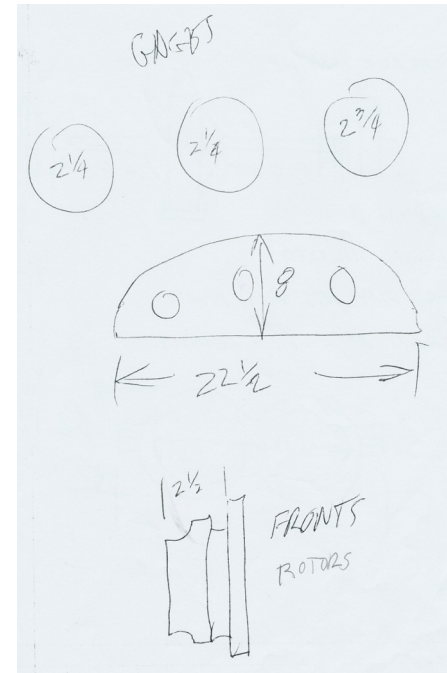
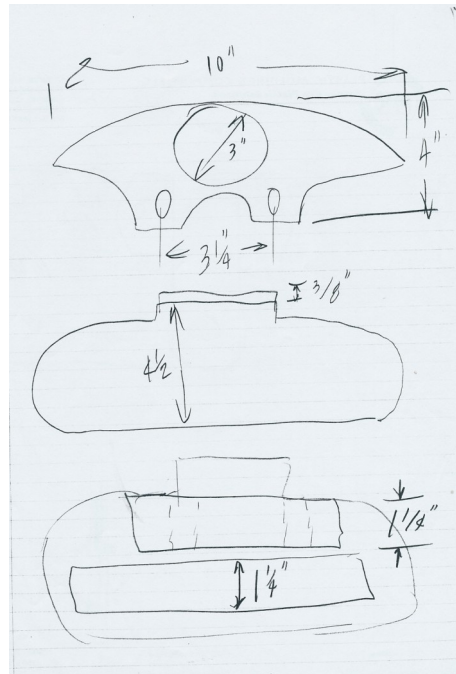
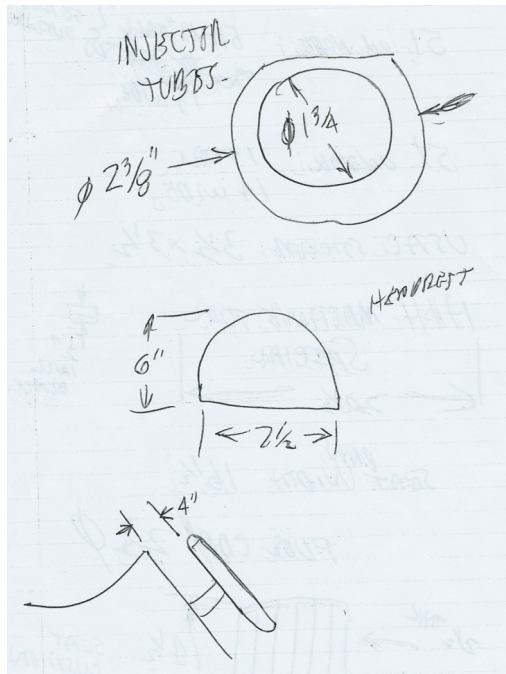
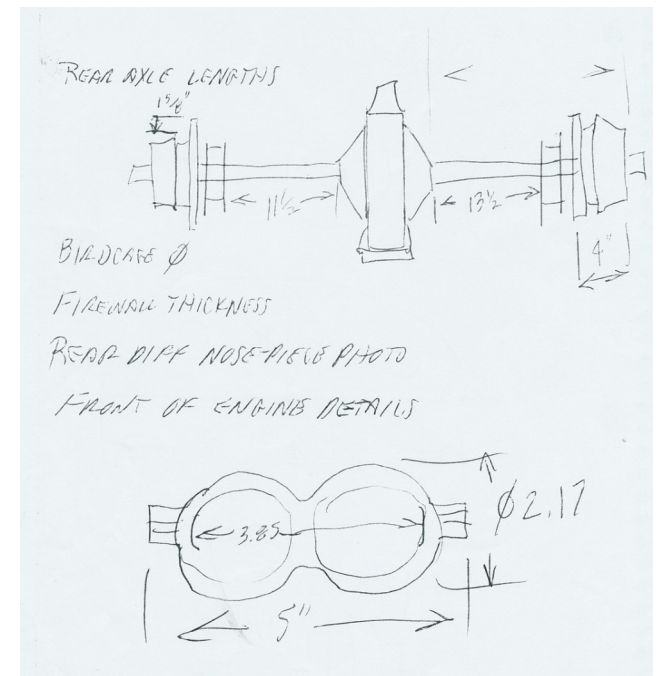
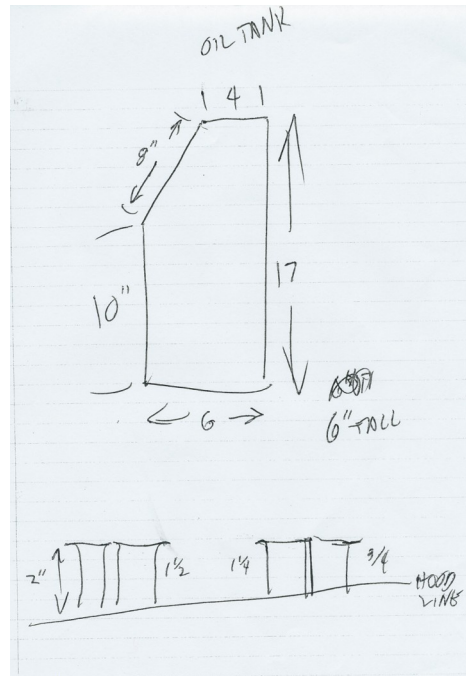
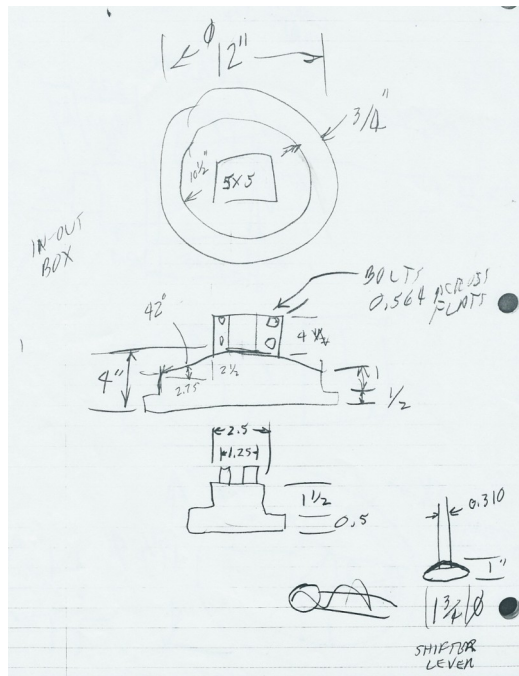
I created these template lists of the major areas of the car prior to returning to the shop to measure the car. This gave me a framework of the important aspects of the vehicle I could refer to during the build. I also knew I would very likely need to return several times during the course of the build to gather additional info.



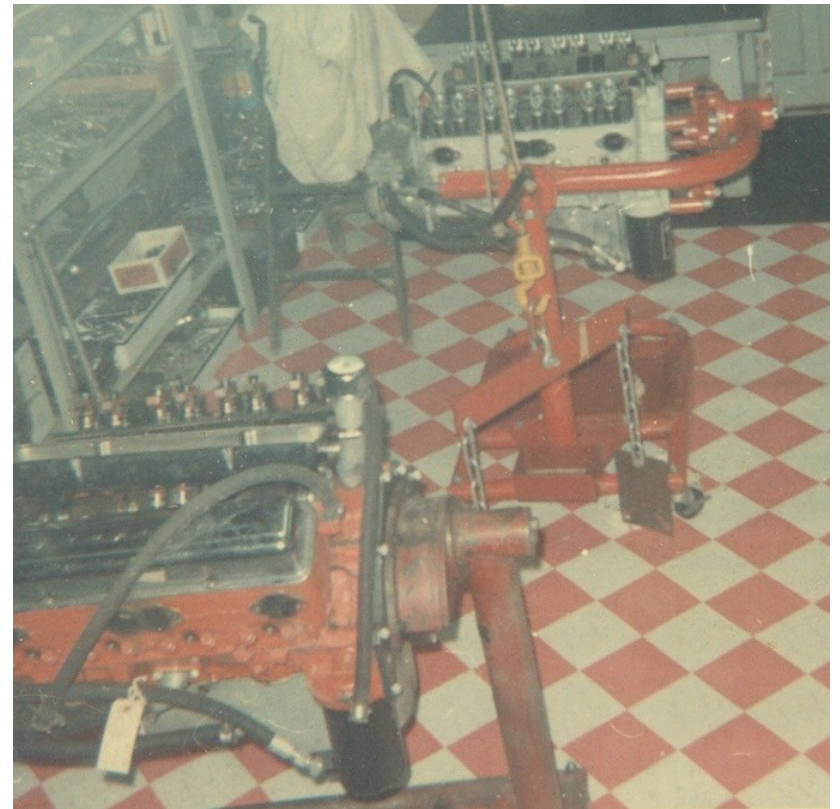
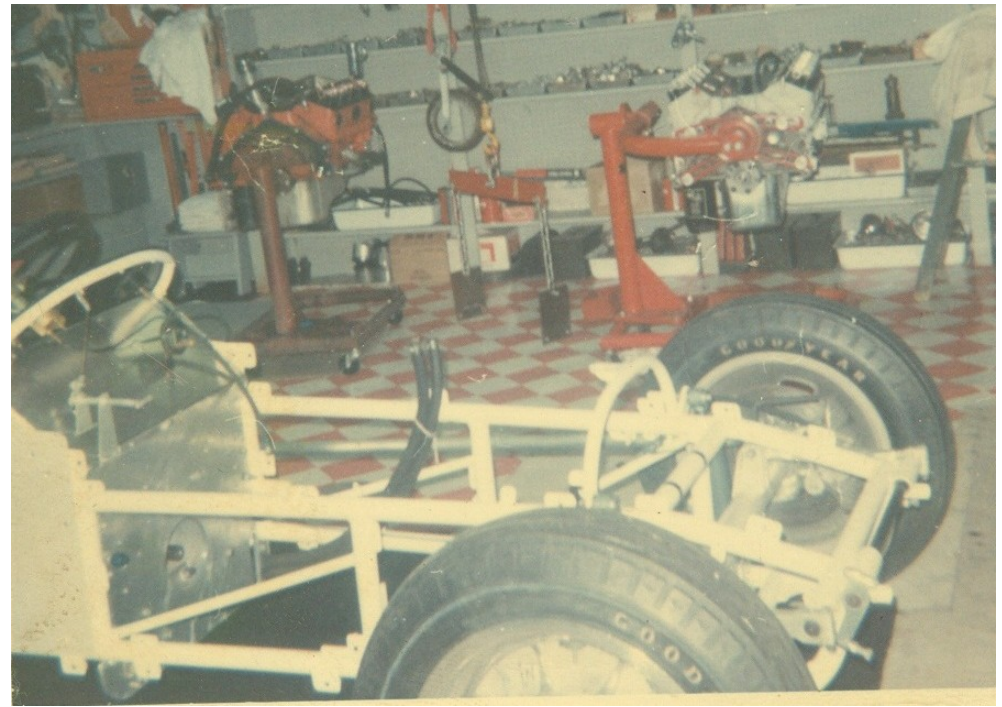
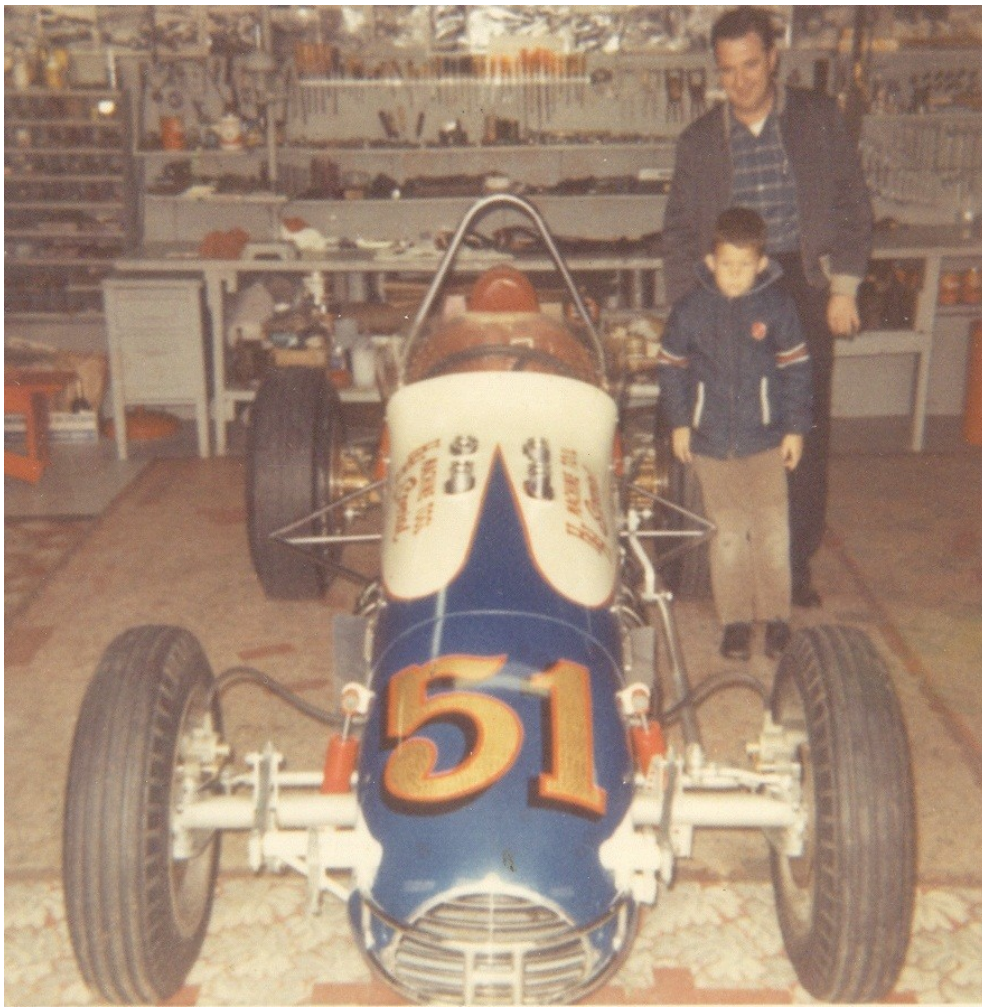
Dozens of sketches such as these were made during those trips to the race shop, as I am a stickler for scale accuracy. I needed as much dimensional data I could get.



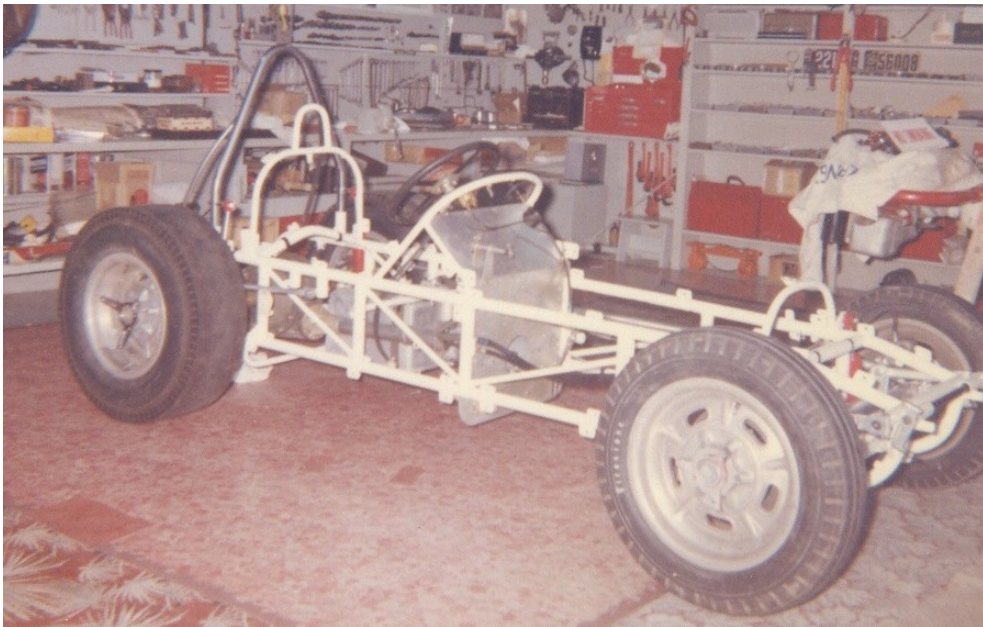
More sketches and measurements.



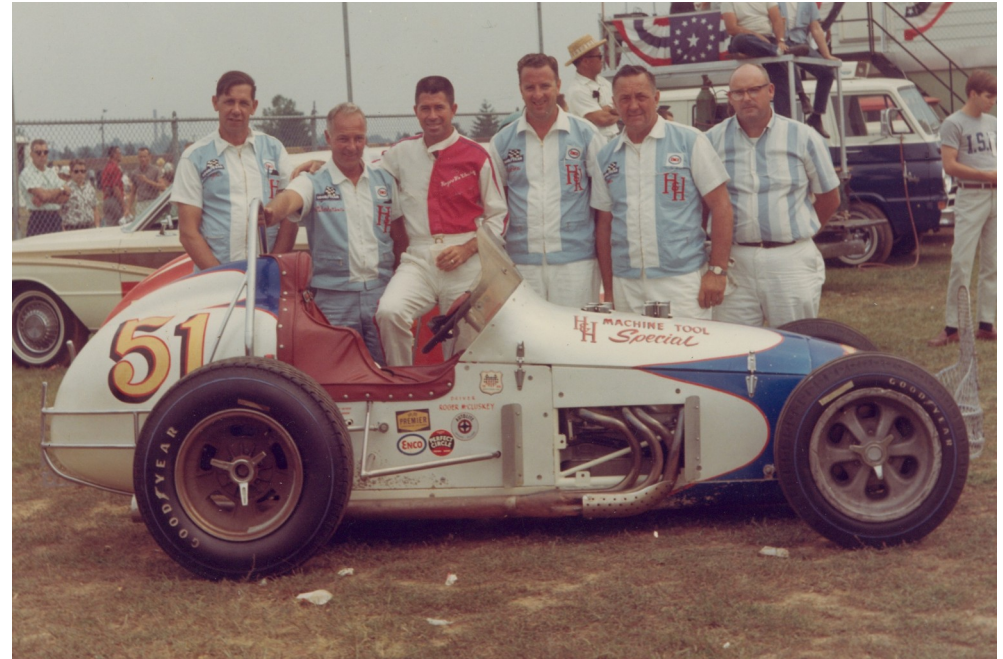
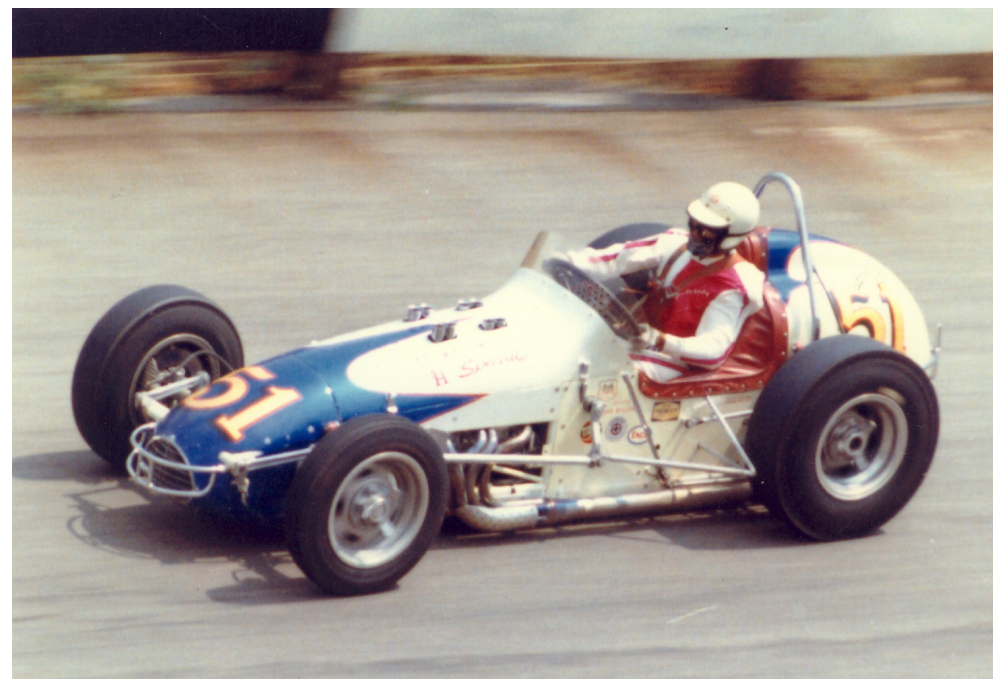
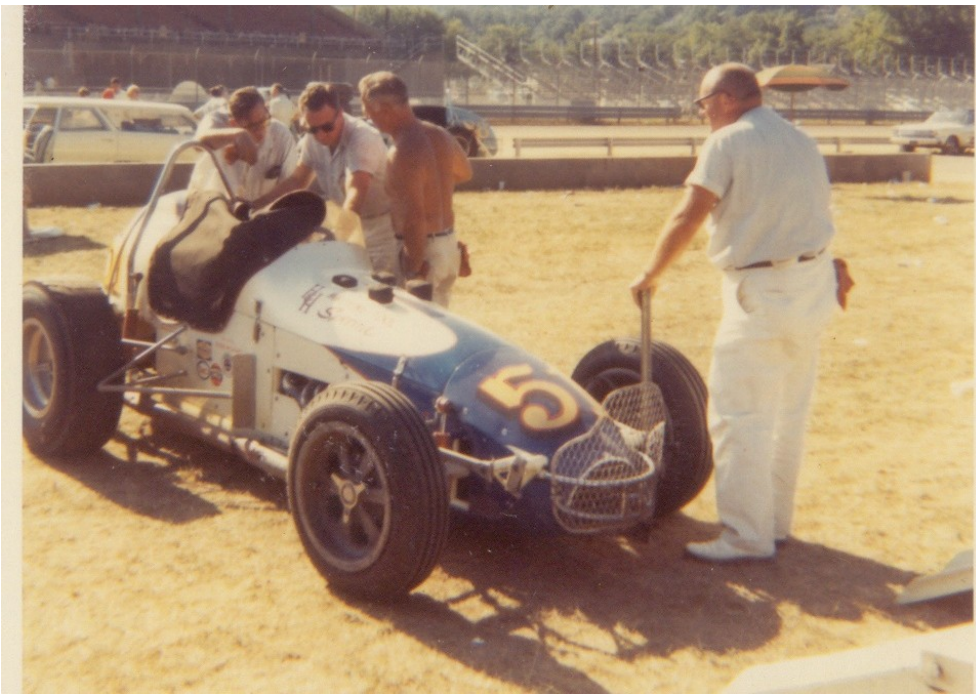
Even more sketches and measurements. You can never have too much dimensional data for a project like this!



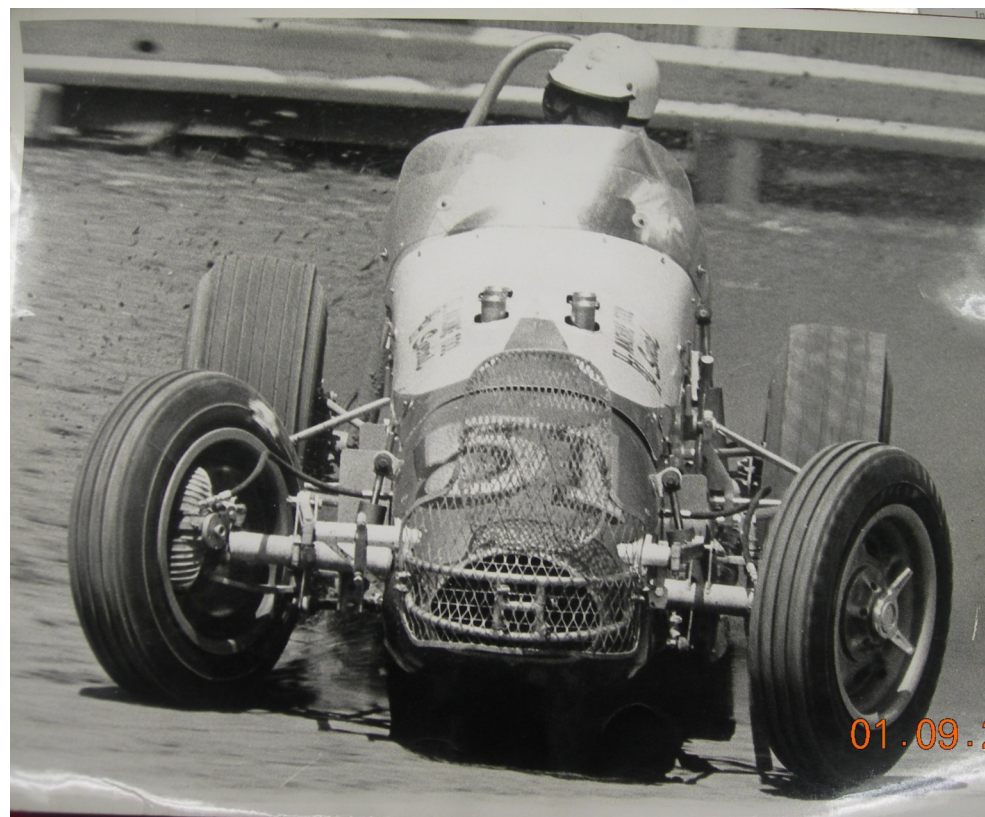
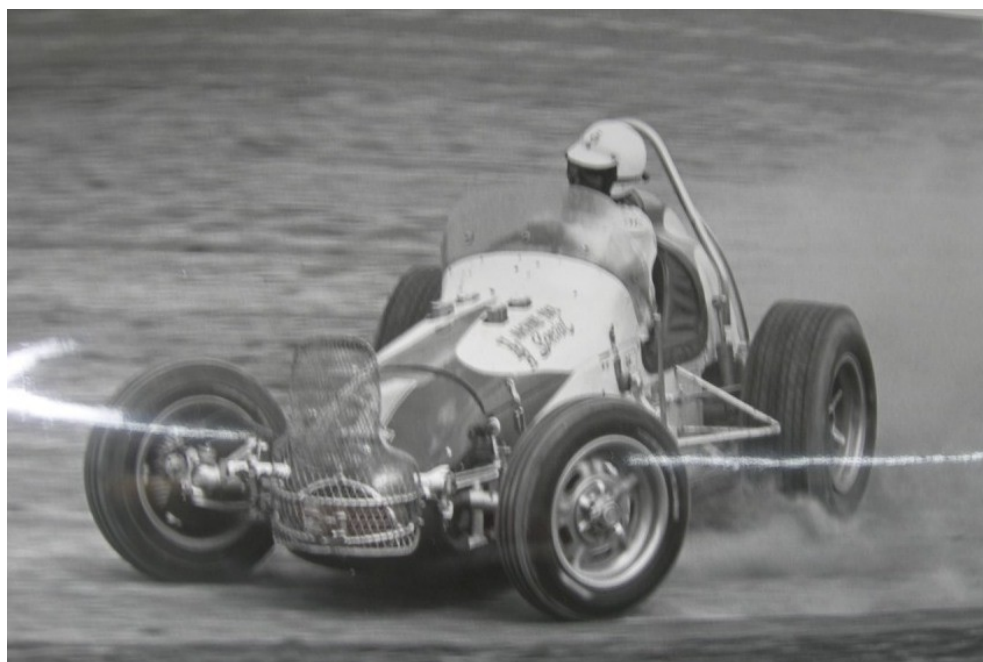
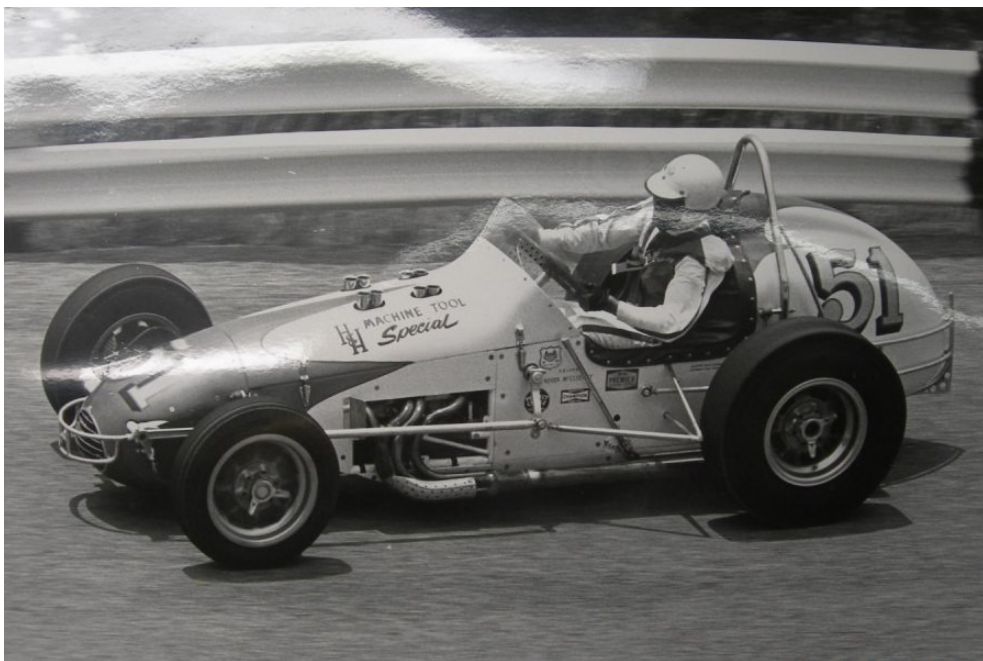
Most amazing to me was how accommodating the Andersons were in helping, even to the point of Mr. Anderson loaning me a stack of original Polaroid photos taken of the car back in 1966 just prior to that championship winning season. These would prove to be instrumental in replicating the car as it originally raced in 1966.



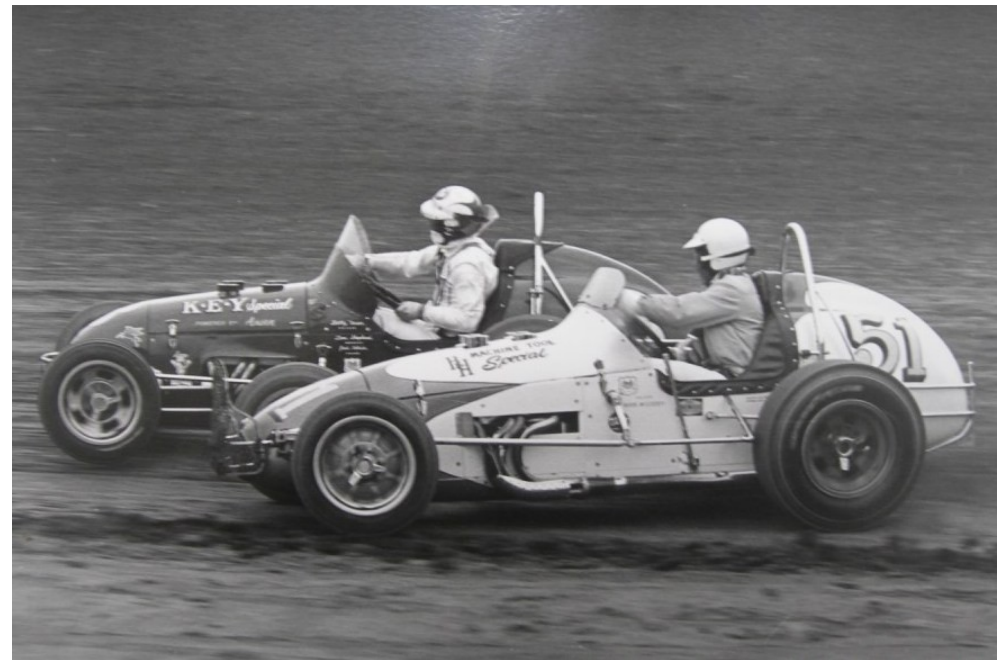
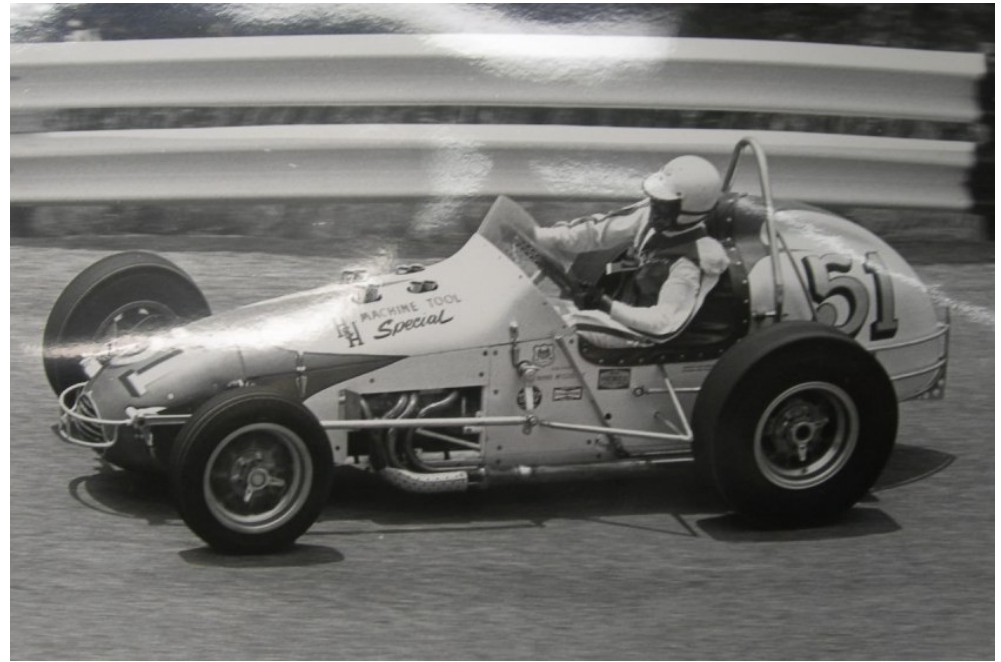
Additional photos from the start of the 1966 season



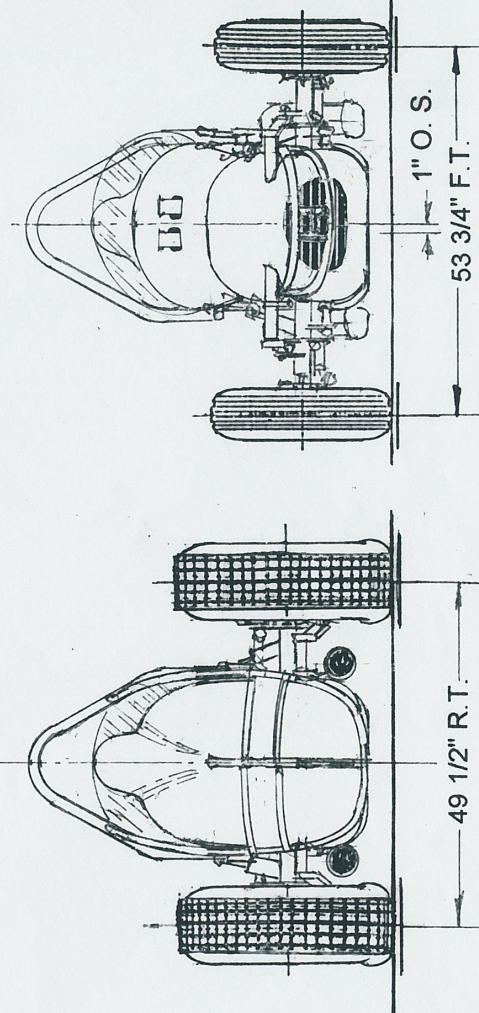
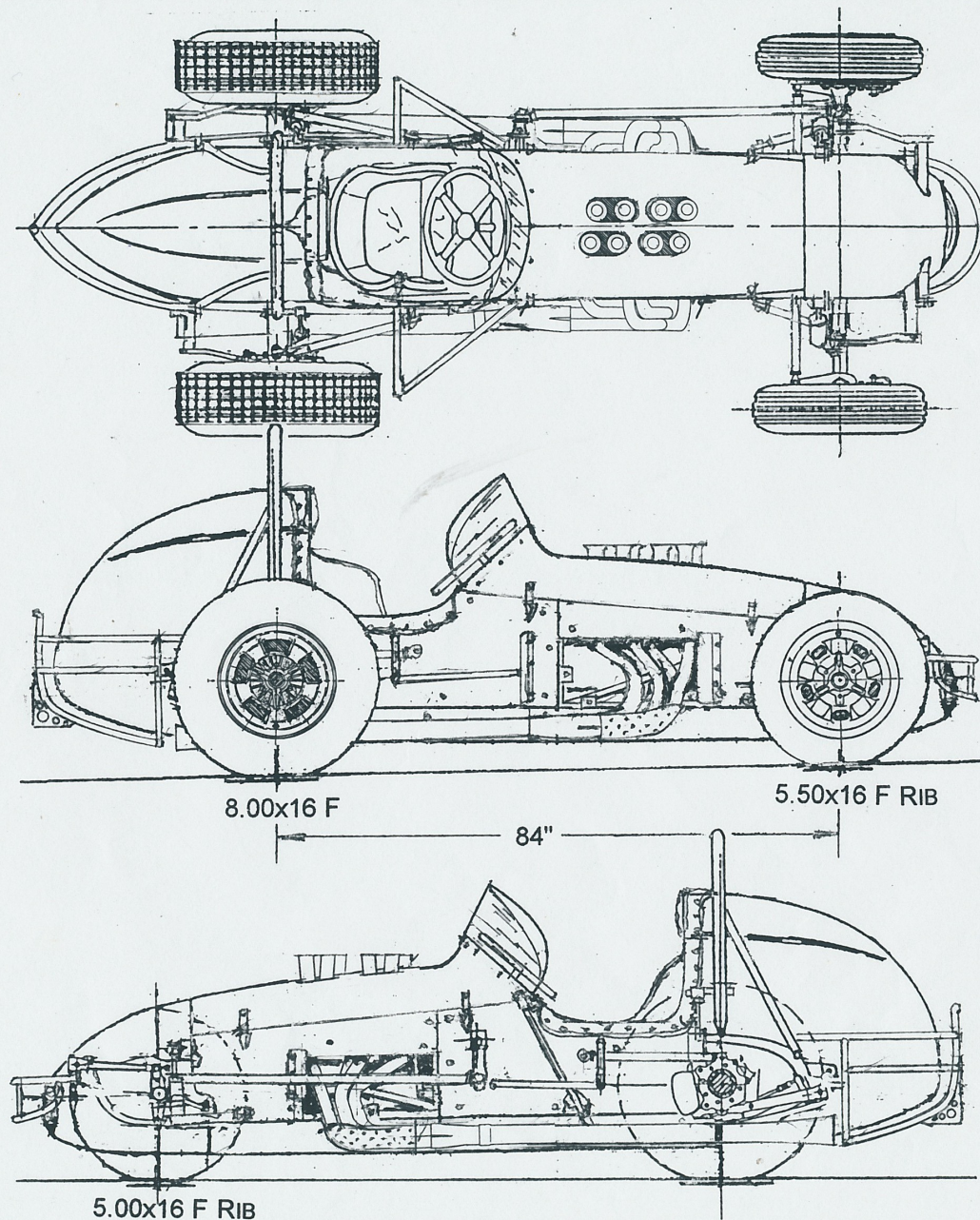
Additional photos from the 1966 season. Copied from photos lining the walls of the Anderson race shop or found on the Internet.



Additional photos from the 1966 season. Copied from photos lining the walls of the Anderson race shop.



Additional photos from the 1966 season. Copied from photos lining the walls of the Anderson race shop.



1966 H&H MACH. TOOL SPL. NO. 51
1963 PHILLIPS BLT. WATSON CHEVY

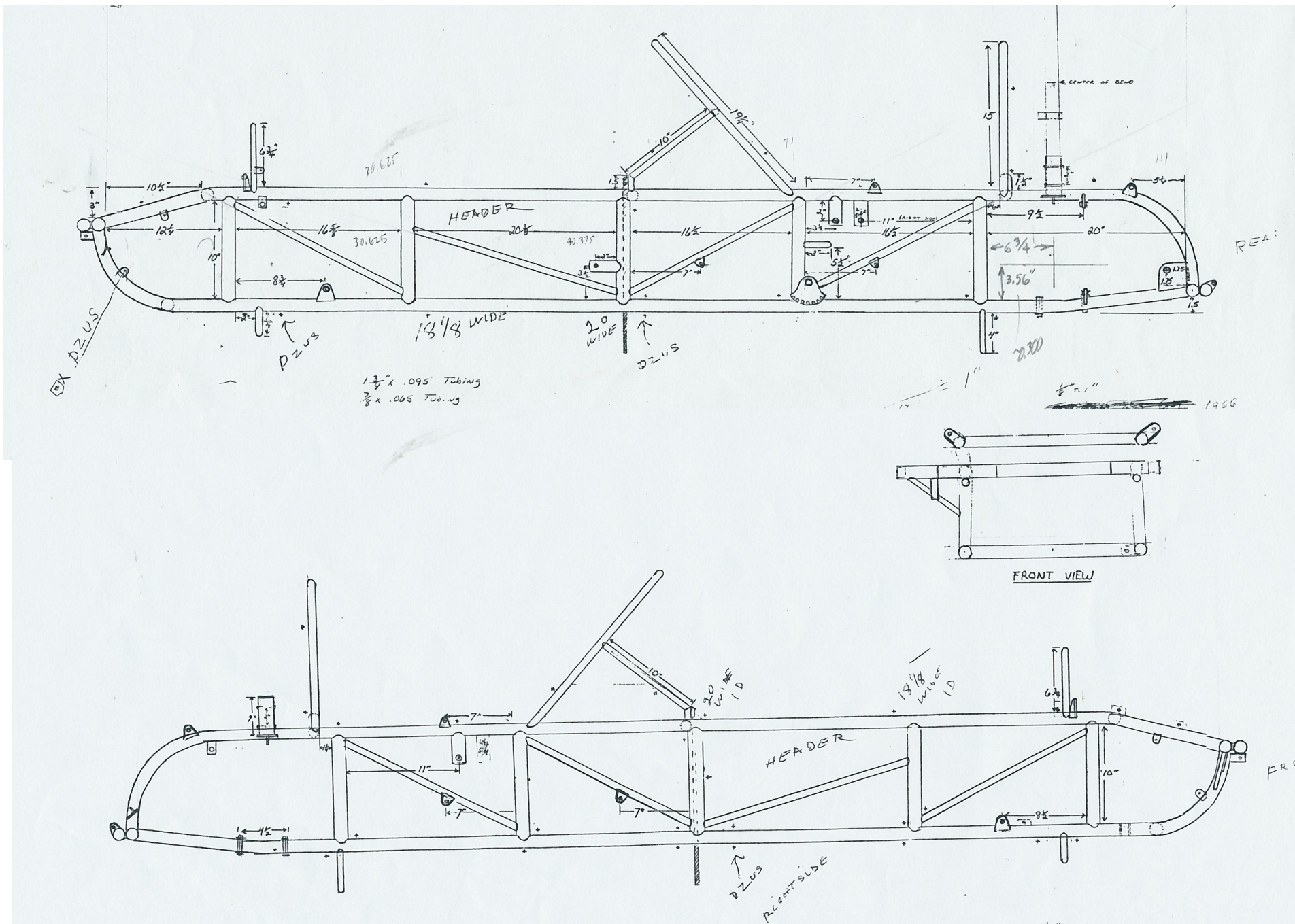
DWN: CLIDINST SCALE: 1/24

DATE: 11-13-98 No. B-6551

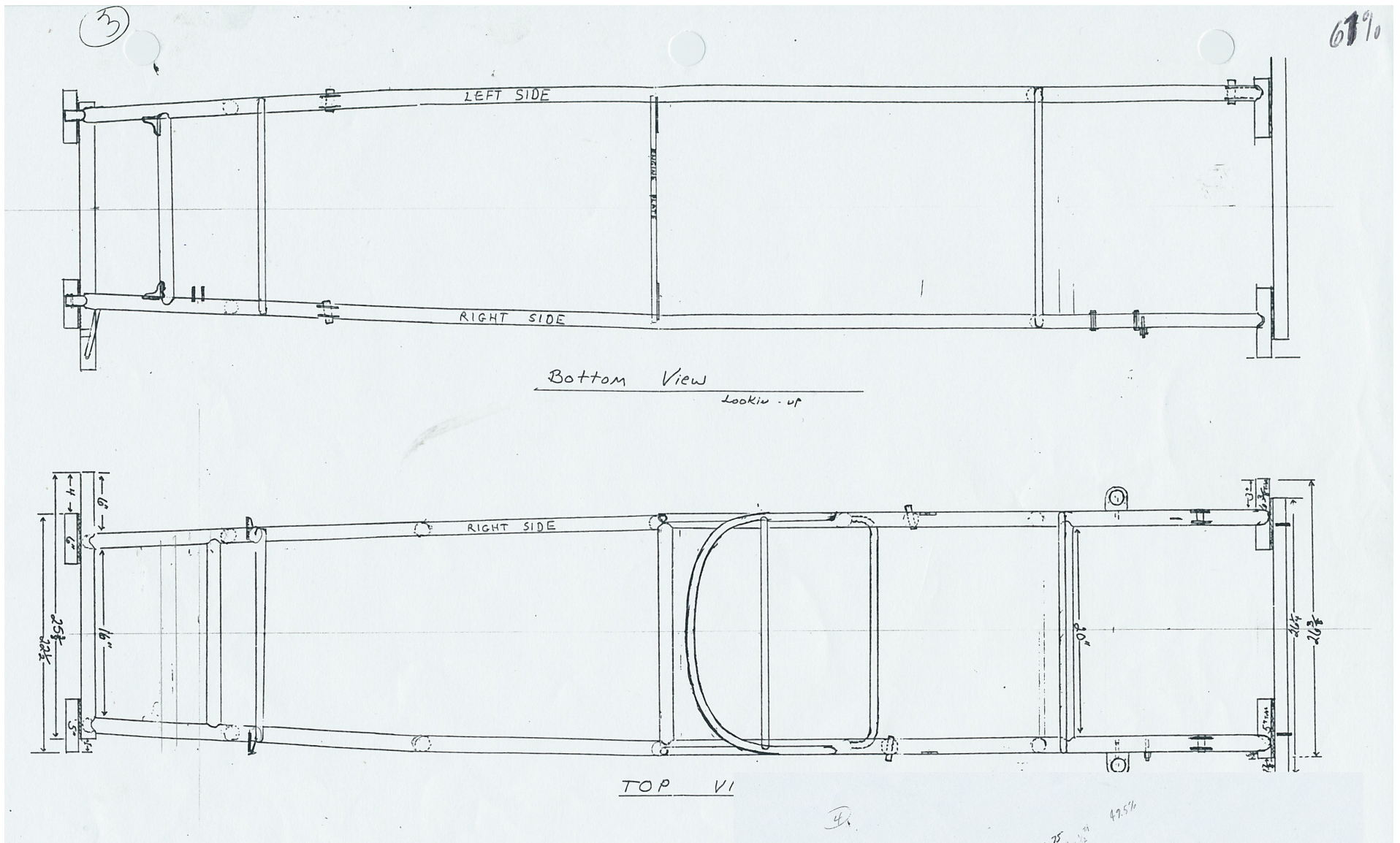
Knowing I needed to build up my knowledge base of sprint cars to properly replicate this dirt track icon, I contacted a modeling friend from Indianapolis, Bob Clidinst. Mr. Clidinst is a well-known historian of vintage sprint and Indy cars, and he also makes drawings of those cars to help fellow modelers with reference information. As luck would have it, he had a drawing of the Jud Phillips-built sprint car in his portfolio, so I obtained a copy from him.

1/8th Scale						English					Metric				
Nominal Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Hex Size	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height
1/4	0.031	0.055	0.021	0.027	3/64	0000-160	0.0210	0.047	0.025	0.025	0.8 UNM	0.031	0.042	0.020	0.025
3/8	0.047	0.070	0.031	0.041	5/64	00-90	0.0470	0.078	0.042	0.040	1.0 UNM	0.039	0.055	0.028	0.032
1/2	0.063	0.094	0.043	0.055	3/32	0-80	0.0600	0.094	0.042	0.048	1.4 UNM	0.055	0.080	0.035	0.040
5/8	0.078	0.117	0.053	0.068	7/64	1-72	0.0730	0.109	0.055	0.063	M2	0.079	0.157	---	0.063
3/4	0.094	0.141	0.063	0.080	9/64	3-	0.0990				---	---	---	---	---
7/8	0.109	0.164	0.072	0.094	5/32	4-	0.1120				M3	0.115	0.214	0.084	0.095
1	0.125	0.188	0.084	0.107	3/16	5-	0.1250				M3	0.115	0.214	0.084	0.095
1 1/4	0.156	0.234	0.105	0.133	15/64	8-	0.1640				M4	0.154	0.273	0.115	0.126
1 1/2	0.188	0.281	0.125	0.160		10-	0.1900				M5	0.193	0.312	0.144	0.158
2	0.250	0.375				1/4	0.2500				M6	0.232	0.389	0.163	0.197
1/12th Scale															
Nominal Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Hex Size	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height
1/4	0.021	0.036	0.014	0.018	1/32	0000-160	0.021	0.047	0.025	0.025	0.5 UNM	0.020	0.030	0.018	0.020
3/8	0.031	0.047	0.021	0.027	3/64	000-120	0.034	0.078	0.033	0.033	0.8 UNM	0.031	0.042	0.020	0.025
1/2	0.042	0.063	0.029	0.036	1/16	00-90	0.047	0.078	0.042	0.040	1.0 UNM	0.039	0.055	0.028	0.032
5/8	0.052	0.078	0.035	0.046	5/64	00-90	0.047	0.078	0.042	0.040	1.4 UNM	0.055	0.080	0.035	0.040
3/4	0.063	0.094	0.042	0.053	3/32	0-80	0.060	0.094	0.042	0.048	1.4 UNM	0.055	0.080	0.035	0.040
7/8	0.073	0.109	0.048	0.063	7/64	1-72	0.073	0.109	0.055	0.063	M2	0.079	0.157	---	0.063
1	0.083	0.125	0.056	0.072	1/8	2-56	0.086	0.125	0.064	0.075	M2	0.079	0.157	---	1.063
1 1/4	0.104	0.156	0.070	0.089	5/32	3-	0.099				M2.5	0.098	0.197	0.067	0.079
1 1/2	0.125	0.188	0.083	0.107		5-	0.125				M3	0.115	0.214	0.084	0.095
2	0.167	0.250				8-	0.164				M4	0.154	0.273	0.115	0.126
1/16th Scale															
Nominal Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Hex Size	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height	Closest Bolt/Nut Size	Shank Diameter	Width Across Flats	Bolt Head Height	Nut Head Height
1/4	0.016	0.027	0.011	0.014	1/32	---	---	---	---	---	---	---	---	---	---
3/8	0.023	0.035	0.016	0.021	1/32	0000-160	0.021	0.047	0.025	0.025	0.5 UNM	0.020	0.030	0.018	0.020
1/2	0.031	0.047	0.021	0.027	3/64	000-120	0.034	0.078	0.033	0.033	0.8 UNM	0.031	0.042	0.020	0.025
5/8	0.039	0.059	0.026	0.034	1/16	00-90	0.047	0.078	0.042	0.040	1.0 UNM	0.039	0.055	0.028	0.032
3/4	0.047	0.070	0.031	0.040	5/64	00-90	0.047	0.078	0.042	0.040	1.4 UNM	0.055	0.080	0.035	0.040
7/8	0.055	0.082	0.036	0.047	5/64	0-80	0.060	0.094	0.042	0.048	1.4 UNM	0.055	0.080	0.035	0.040
1	0.063	0.094	0.042	0.054	3/32	0-80	0.060	0.094	0.042	0.048	---	---	---	---	---
1 1/4	0.078	0.117	0.053	0.066	1/8	1-72	0.073	0.109	0.055	0.063	M2	0.079	0.157	---	1.063
1 1/2	0.094	0.141	0.063	0.080		3-	0.099				M2.5	0.098	0.197	0.067	0.079
2	0.125	0.188				5-	0.125				M3	0.115	0.214	0.084	0.095

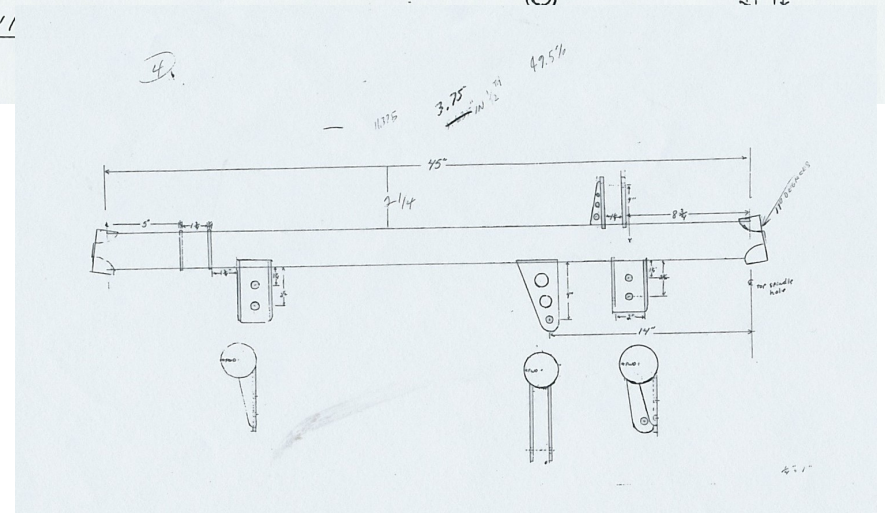
One major decision I still needed to make was that of scale; What scale should I select for this build? I had narrowed it down to three choices: 1/16th, 1/12th, or 1/8th. I knew that regardless of scale, I would be scratch-building virtually every component, as the only kit-based sprint car components were in either 1/25th or 1/24th scale. It occurred to me this project would require many fasteners to be either bought or fabricated, so I compiled a list of the commercially available hardware and converted those sizes to the three scales in question. As I studied the results, it became clear that 1/12th scale would allow for the use of those available fasteners to replicate the typical hardware used; 1/4", 3/8" and 1/2" bolts and nuts.

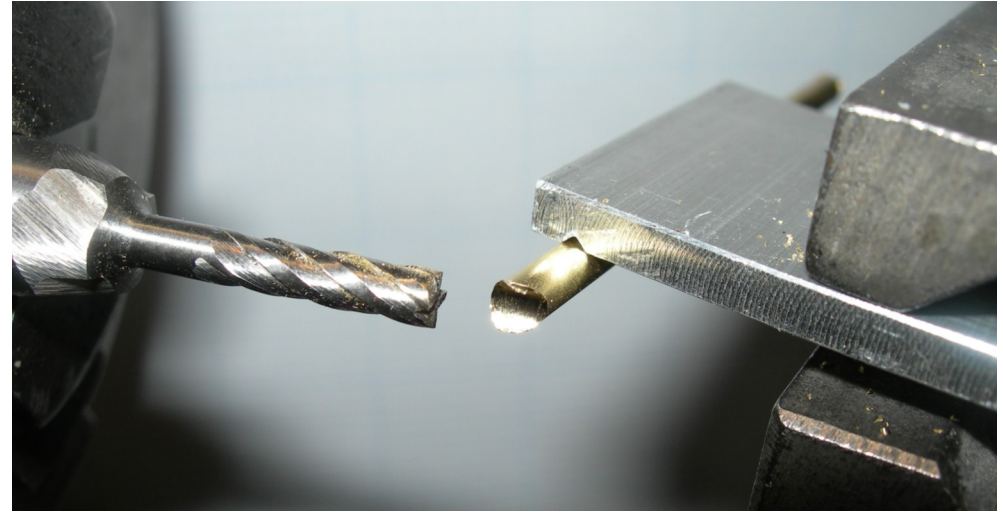
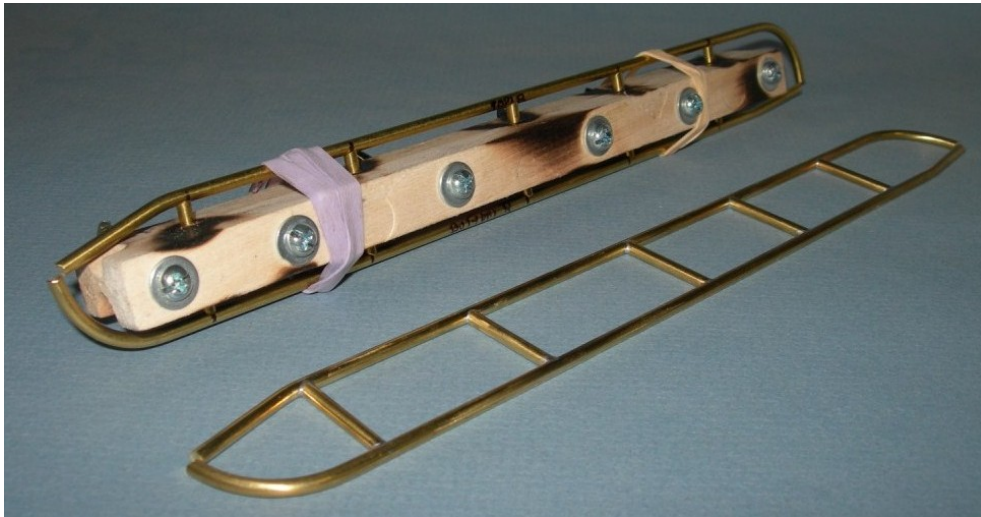


I was also able to obtain copies of the drawings Mr. Anderson used to recreate the frame for the restored car, and I reduced these on a copier to make them equal to 1/12th scale. That way I could measure directly off the drawing without the need for conversions.

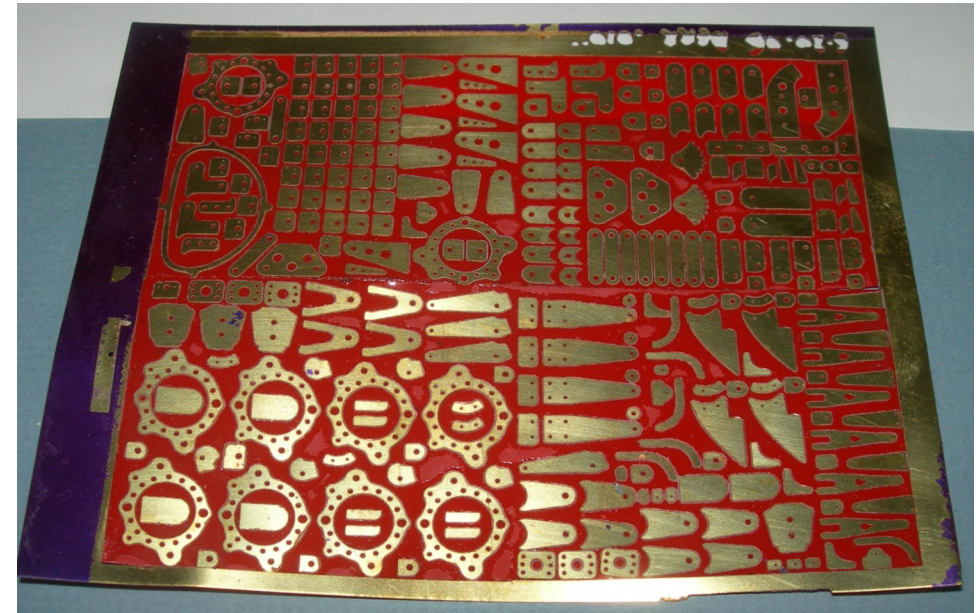
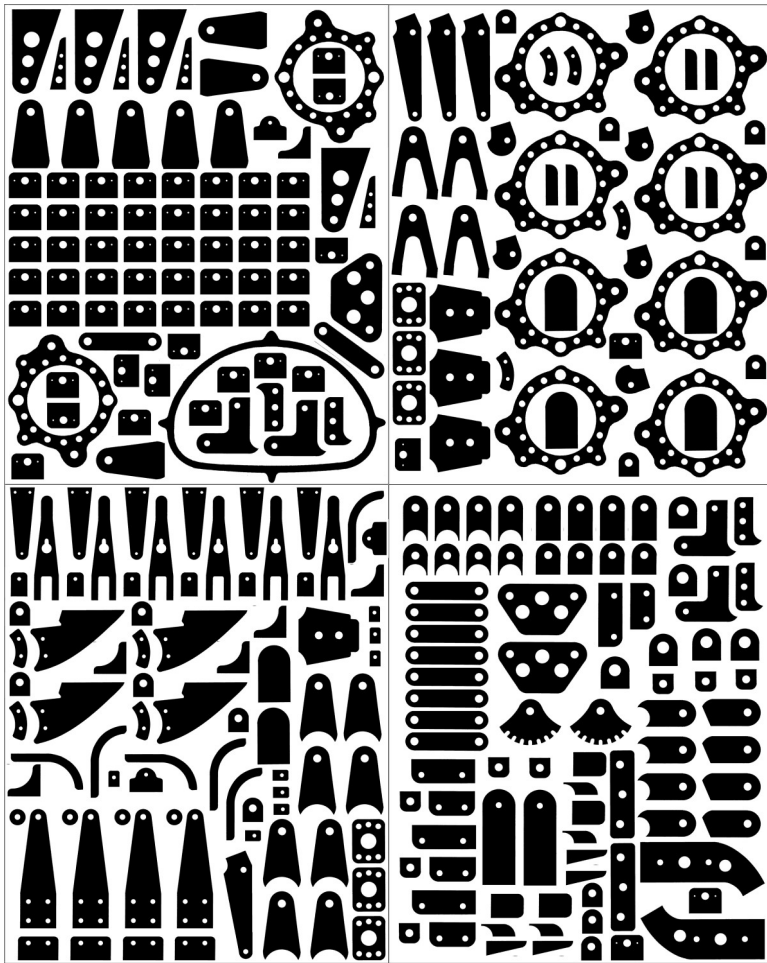


Chassis drawings used for recreating the restored car chassis and front axle assembly.

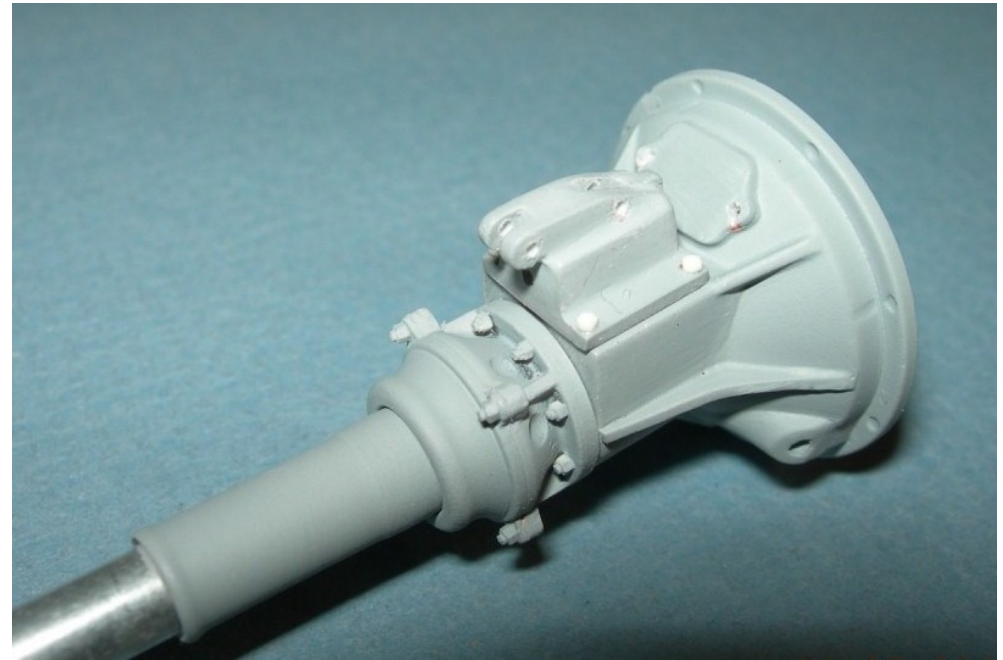




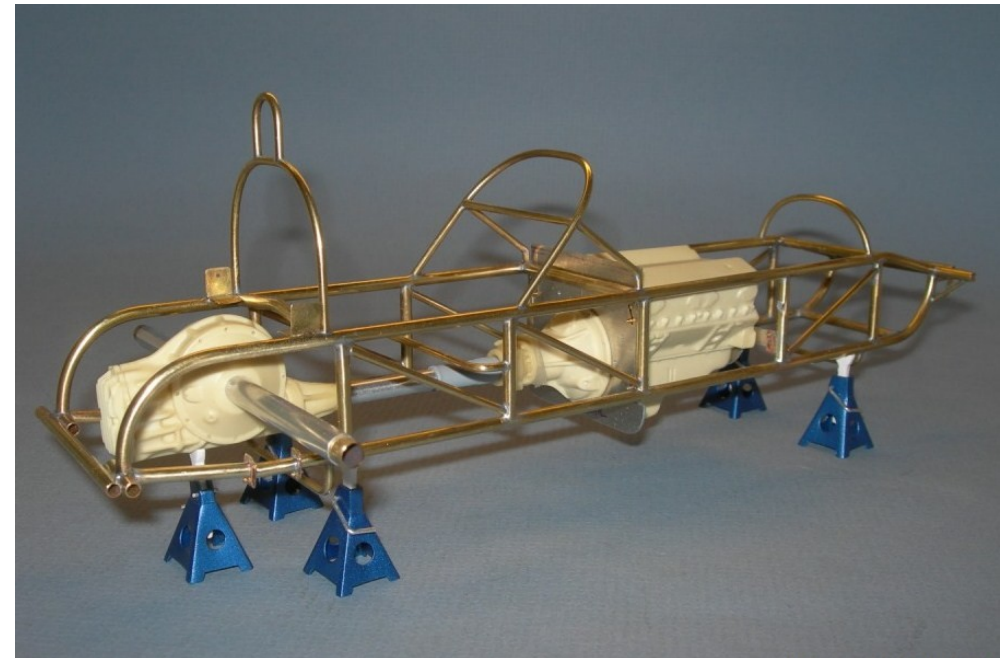
Construction of the model began in May 2006 with the building of the basic frame. It was constructed using 0.114" diameter brass rod, silver-soldered together using a small butane torch. The ends of the "frame tubes" were fish-mouthed using a 1/8" end mill and a special fixture to hold the piece during the machining process. This provided the best possible fit to the top and bottom rails to make the solder joints stronger. The vertical bars were held in place using a wooden fixture during the soldering to ensure perfect alignment and location. The front and rear torsion bar tubes were made from brass tubing and added to the frame.

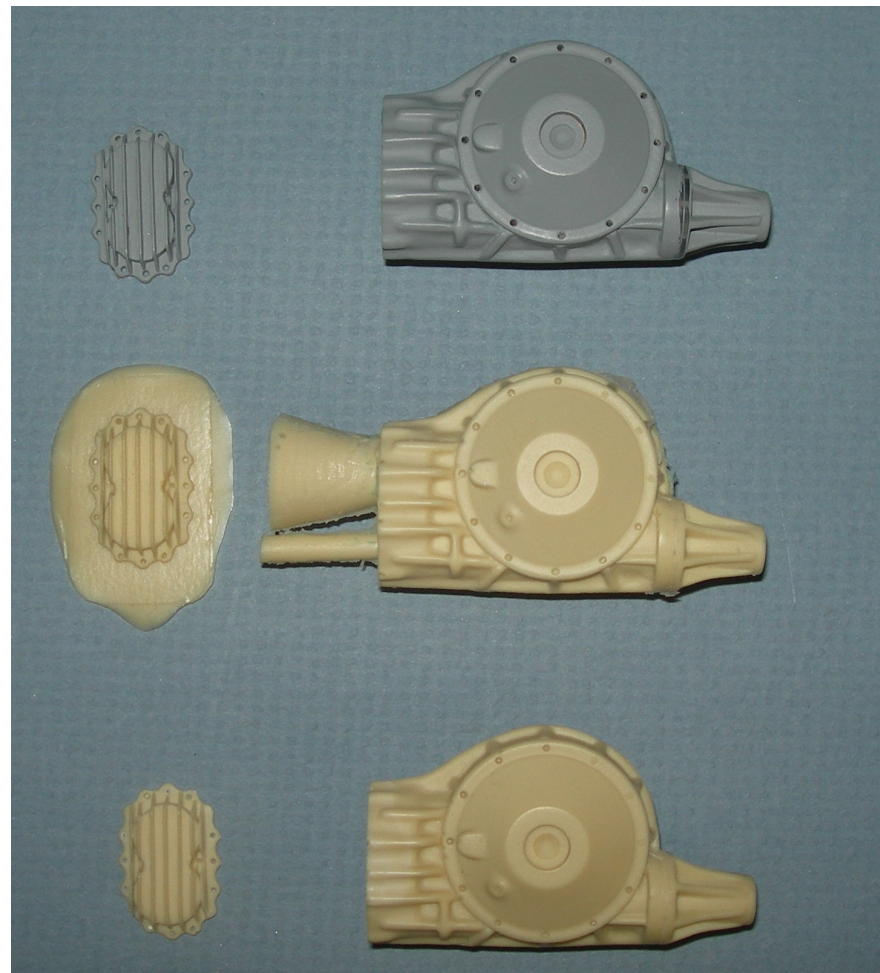
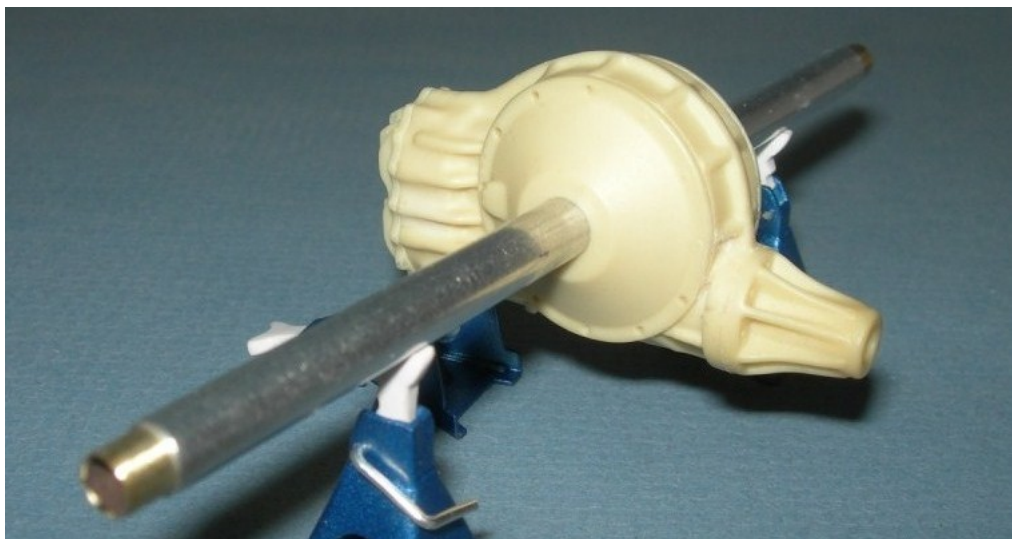
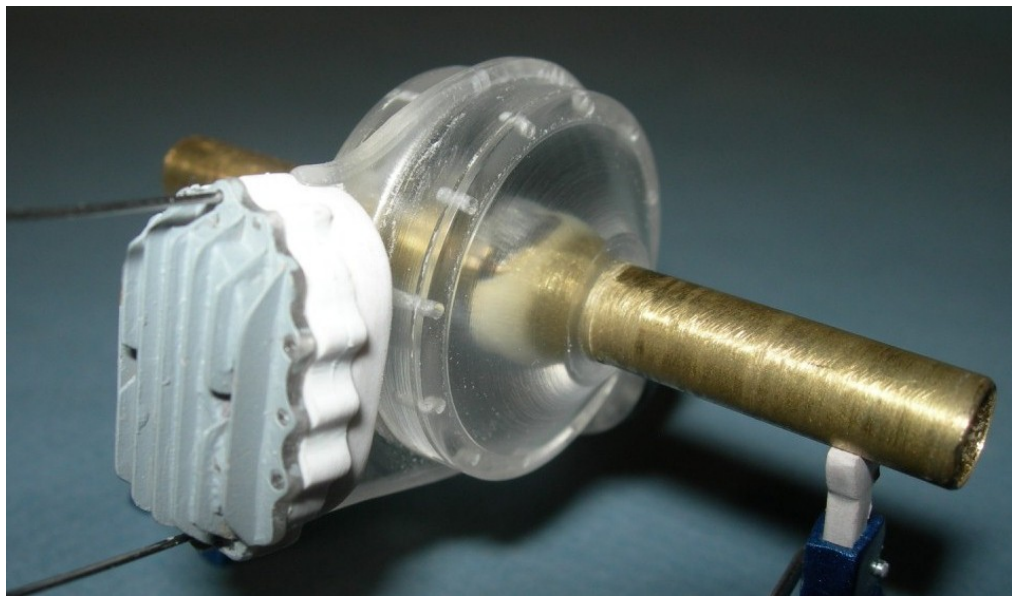


With the basic frame completed it was time to move onto the suspension and front axle assembly. In order to replicate those, I needed to create a number of specialized brackets and plates, which could be readily made using the photo-etch process. I drew the artwork for the various brackets, tabs, plates, etc..., put it all together into an image file, and then sent it off to Fotocut to etch the parts out of 0.010" brass. I knew I would most likely need additional custom photo-etch later in the project, but this would be enough to get started.

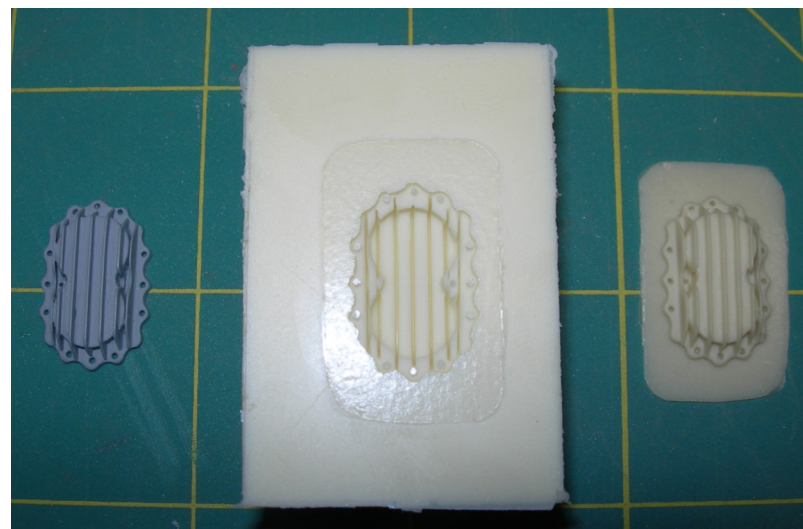
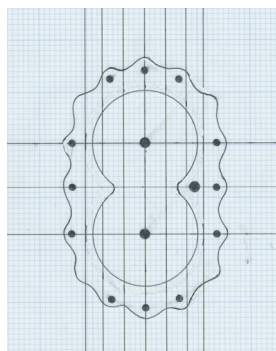


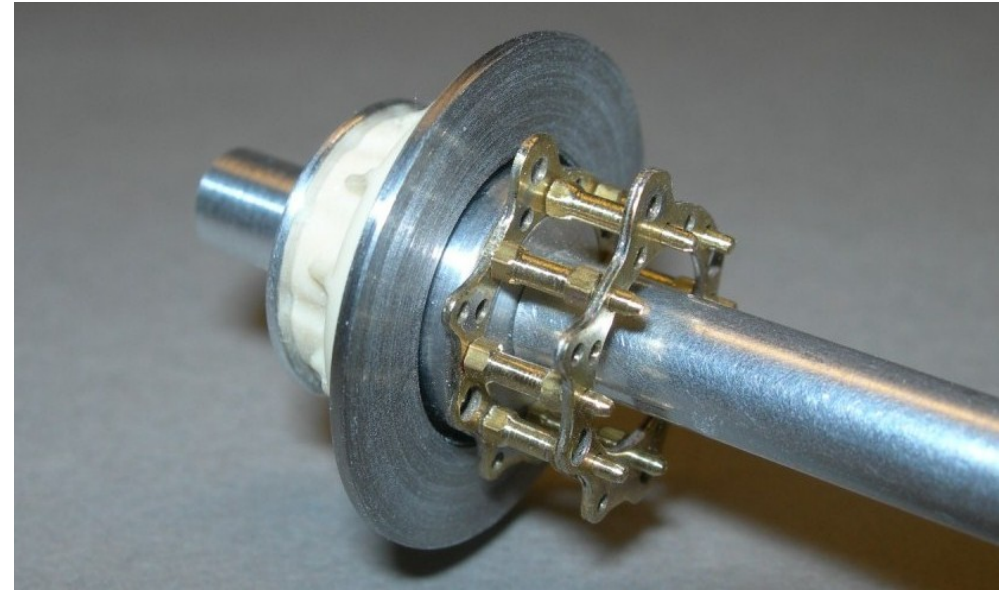
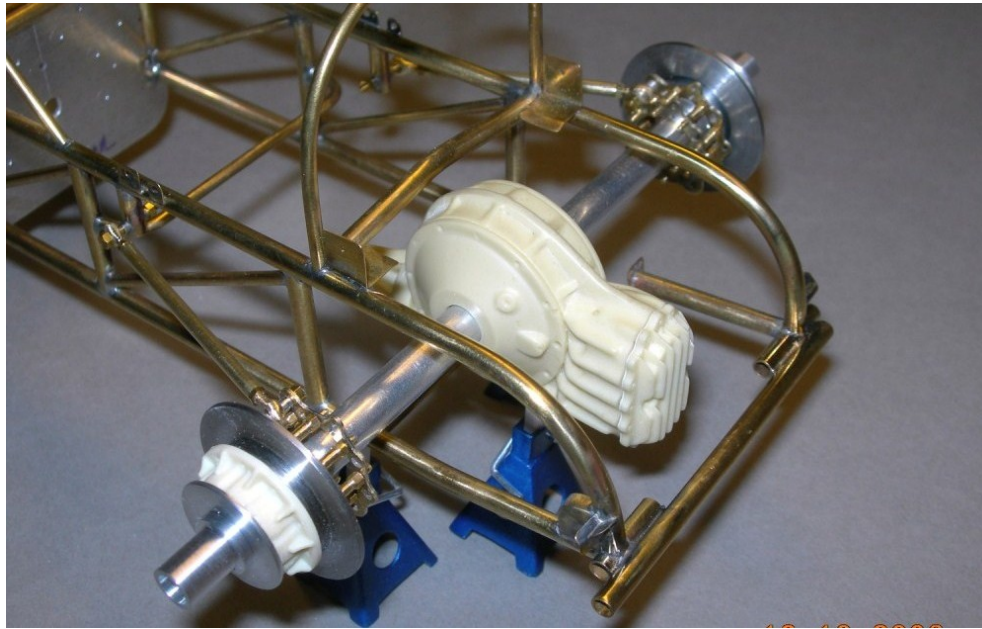
While waiting for the photo-etch to arrive, I began fabricating the drivetrain, which consisted of a Chevy small block engine, a Culbert Automotive Engineering in-and-out gearbox, and a Halibrand quick-change rear end. The engine block and heads were modified resin castings based on the SBC engine in the Monogram '57 Chevy kit. These production car-based pieces were modified to replicate the race engine. The gearbox was a resin casting made from a scratch-built master. These were installed into the frame utilizing an aluminum firewall and front plate.



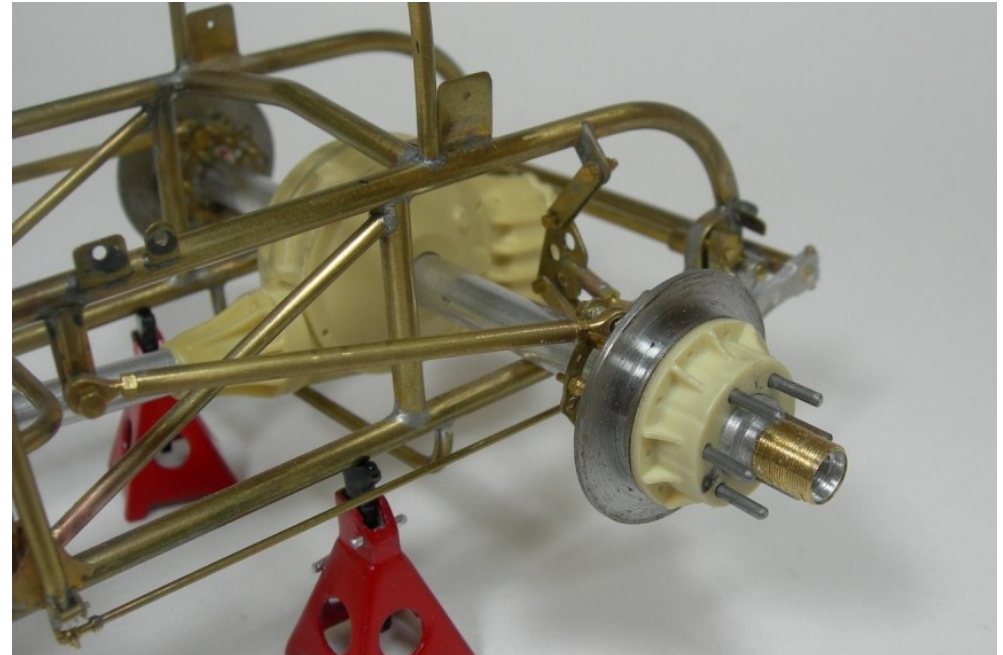


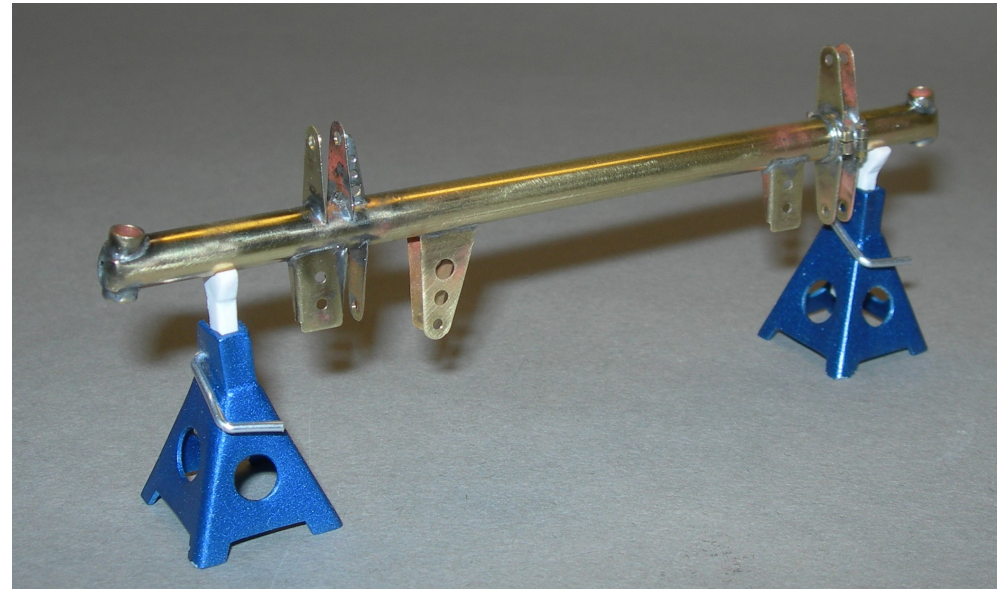
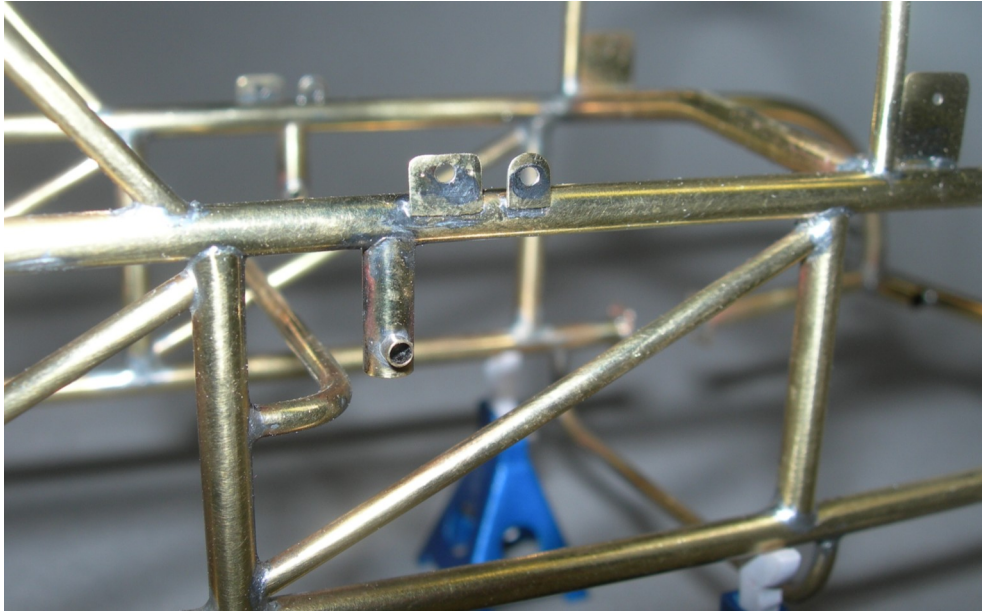
The Halibrand quick change differential was scratch-built using Plexiglas and styrene shapes and then cast in a three-piece RTV mold. The rear cover was mastered using styrene with 0.010" thick brass fins inserted into saw-cut slots and then cast in resin as well. To avoid paint build-up, fasteners would be added after painting.



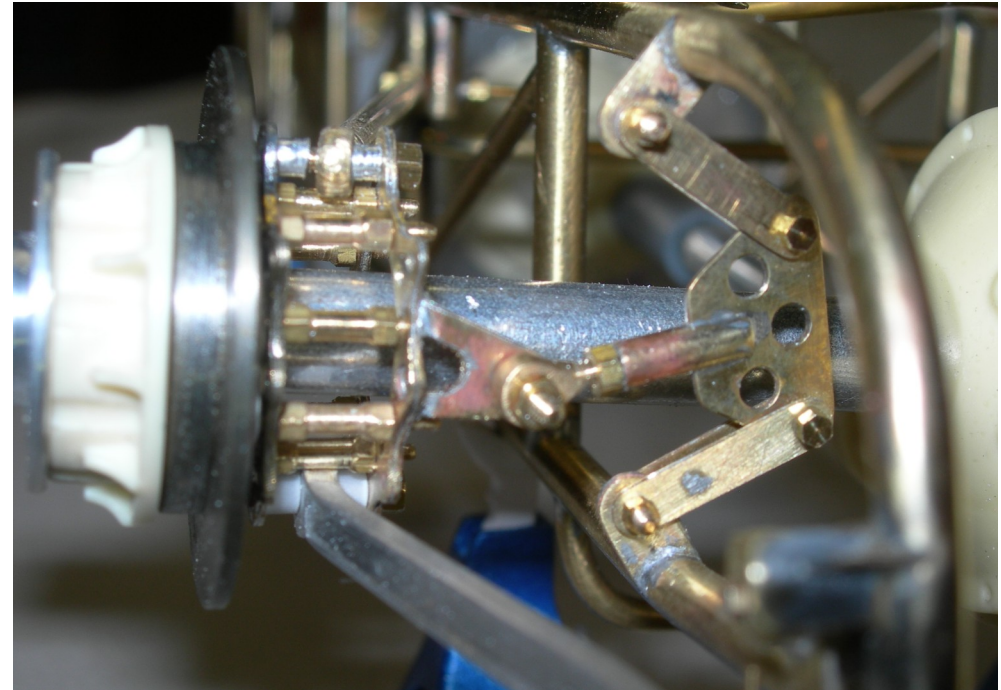


With the arrival of the photo-etch, I was able to start adding brackets to the frame and begin building the suspension pieces. The rear axle birdcages were made from photo-etched plates, with machined brass tie bolts made from 0.063" hex stock. Rear brake rotors were machined from 1214 steel to replicate the finish and sheen of the full-size parts. Suspension links were fabricated from 0.078" diameter heavy-wall brass tubing, threaded inside the ends to accept a 00-90 threaded stud. Rod ends were machined from brass rod and cross-drilled to form the spherical end. Some of the various brackets and tabs attached to the frame are also visible in these photos. Attaching those to the brass frame would prove to be a challenge and required a specialized set-up: a resistance soldering rig.





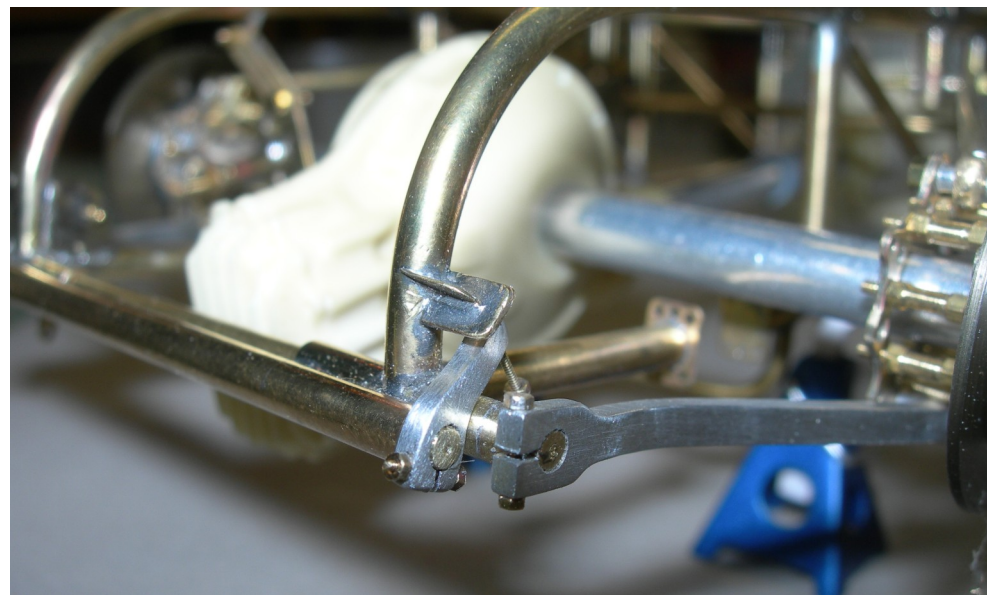
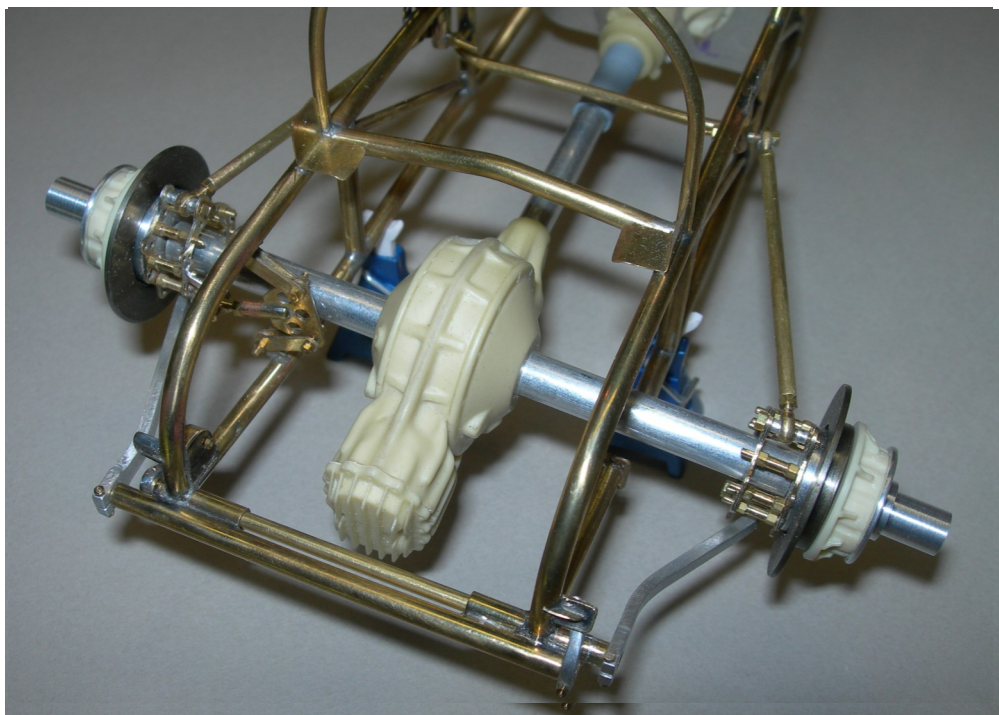
One of the common challenges associated with working with brass is the attachment of very small pieces to larger pieces. The great difference in the two parts' thermal mass makes soldering them together a tricky proposition. If you use a soldering torch or iron, too much heat is transferred to the small part in the process of getting enough heat into the larger part. Even if you can direct the heat to the larger of the two parts, it is almost impossible to solder multiple small parts close to one another without desoldering the others nearby. A resistance soldering rig avoids this difficulty as it heats the parts by passing a low voltage, high level electrical current through the parts. The interface where the two parts join is a high resistance area, so high heat is generated in this region, and the two parts can be joined easily without damage to either part or adjacent components.



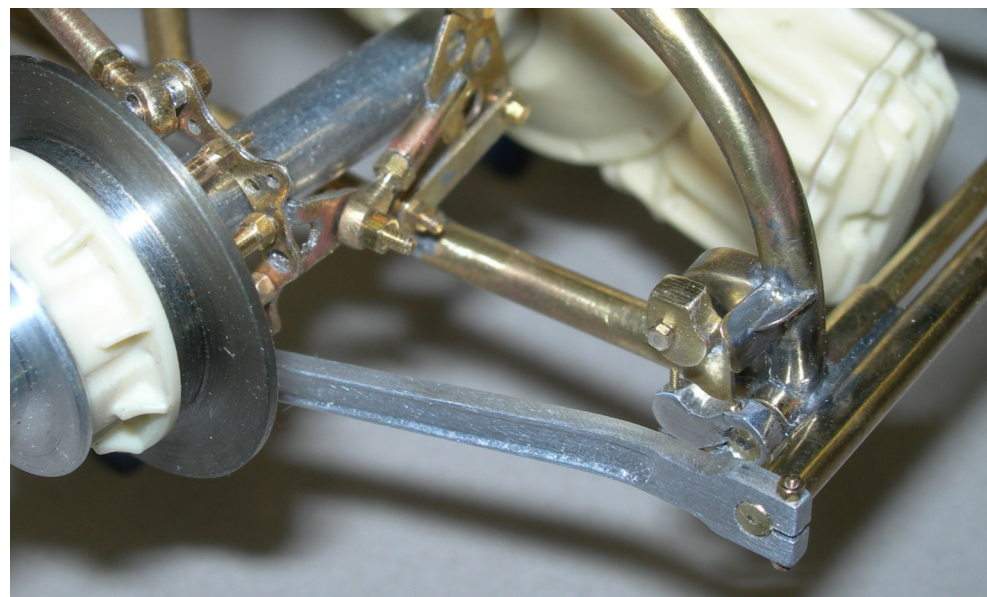


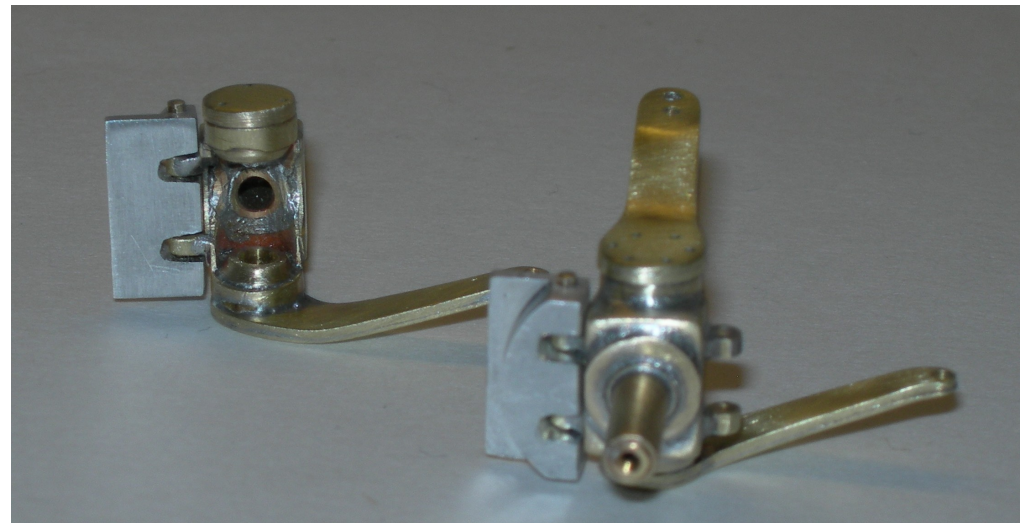
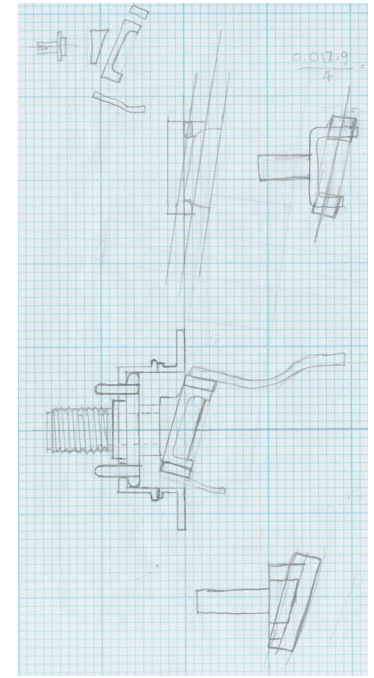
A serious downside to the use of the resistance soldering technique is the cost of such a device, often in the range of \$400—\$500 for a basic set-up. After a bit of Internet research into the subject, combined with a basic understanding of electrical systems, I was able to assemble such a device for a fraction of the cost of a commercially available set, using readily available components. In the end I spent less than \$80 for my set-up and it works great. There simply was no other method that would have worked on this model. (I have to admit, however, I felt a bit like Thomas Edison when I tried it out for the first time and it actually worked!)



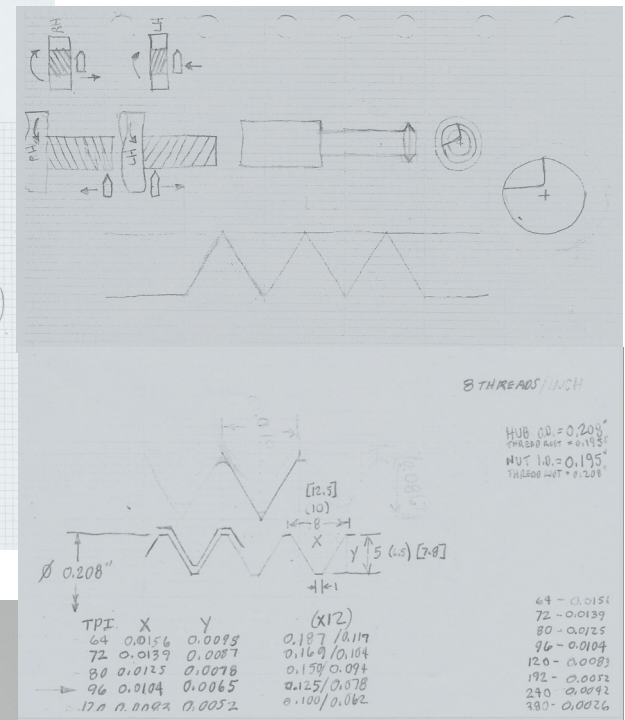
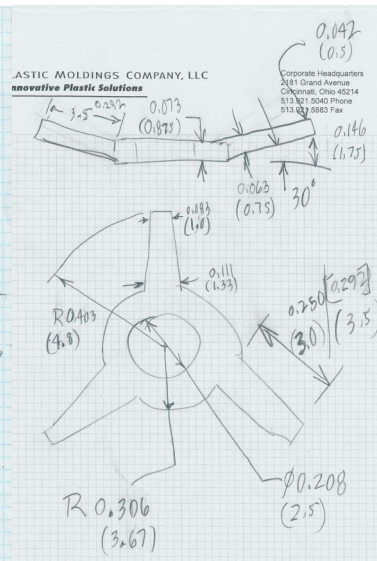
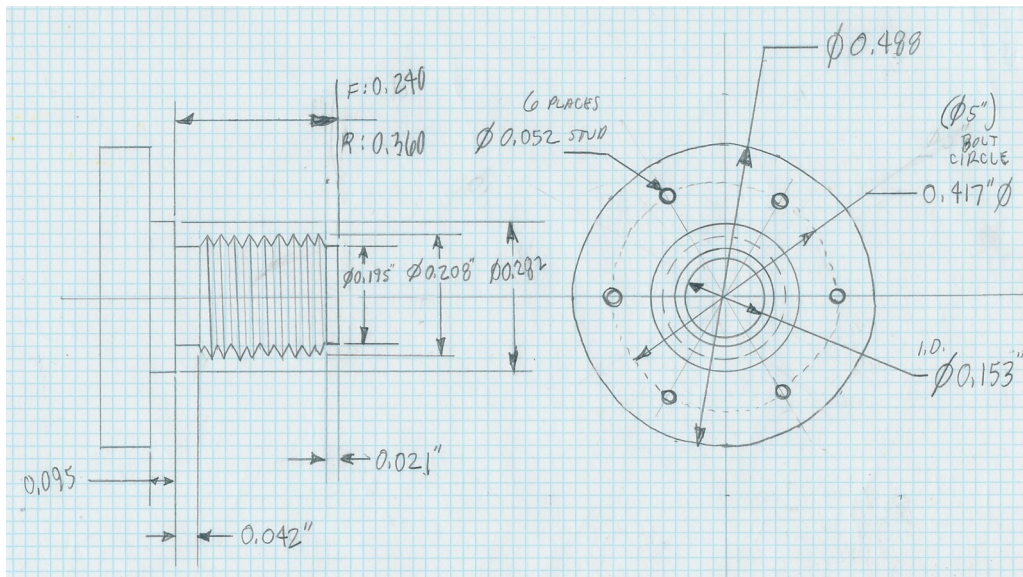


The rear suspension was finished with completion of the torsion bars, links, and adjusters. The bars were made from brass rod, splined on the ends to accept the links. These links were cut from 0.063" thick aluminum and filed to shape. The side scallops were milled using a 0.060" end mill. The bar attachment ends were cut using a 0.005" thick saw blade and then drilled to accept the clamp bolts made using 0000-160 threaded rod and nuts. The adjusters were made in the same fashion. These all were eventually polished to resemble chrome plated parts.

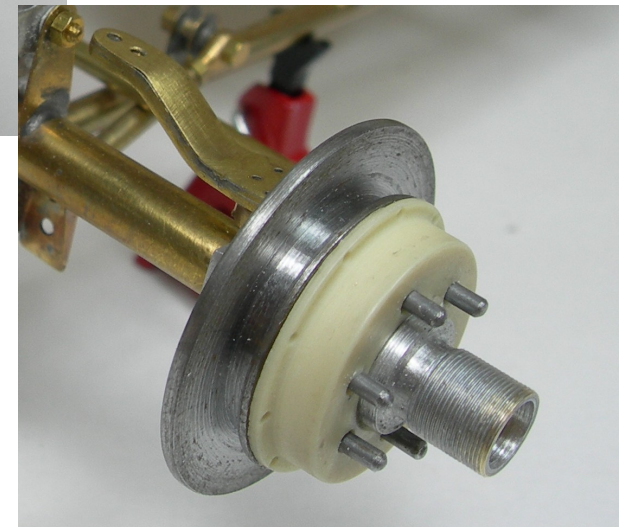
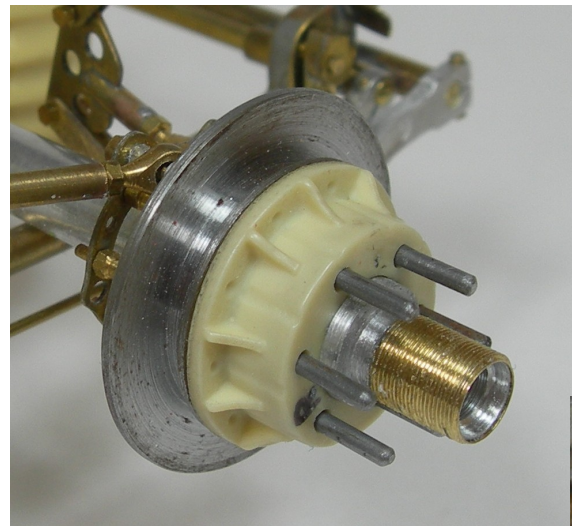


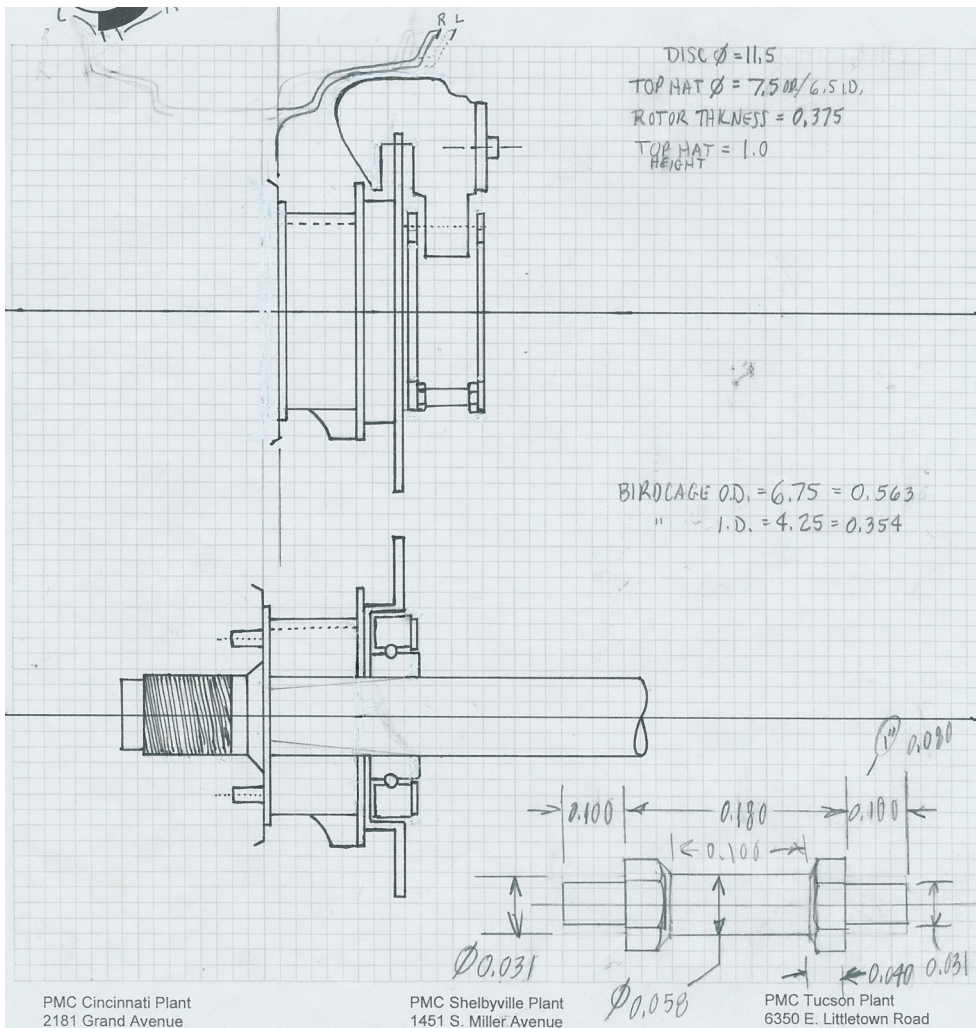


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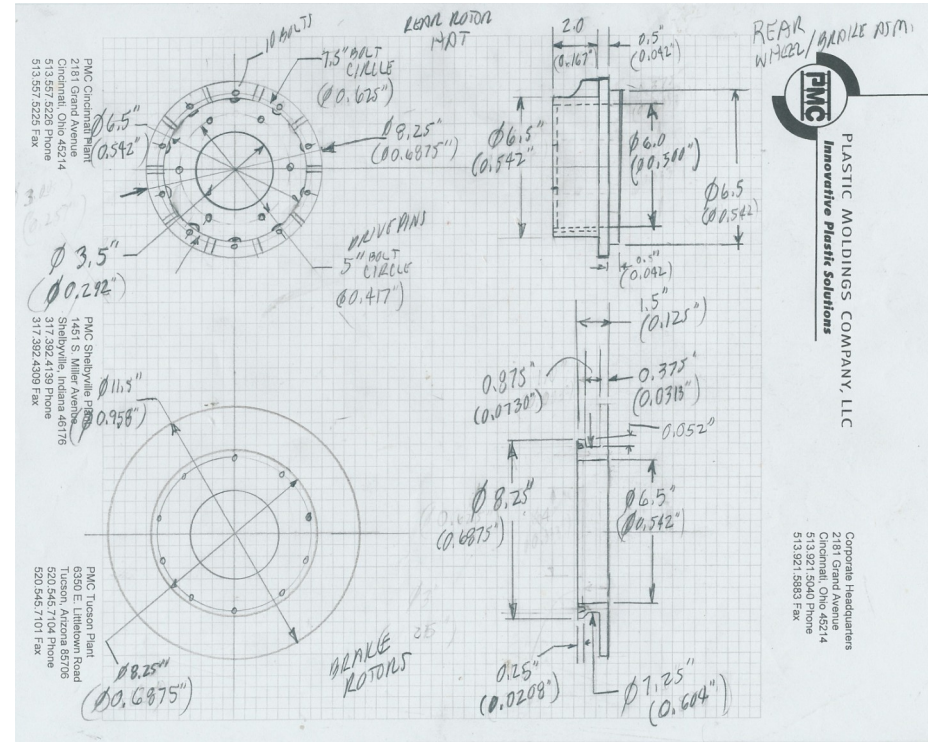
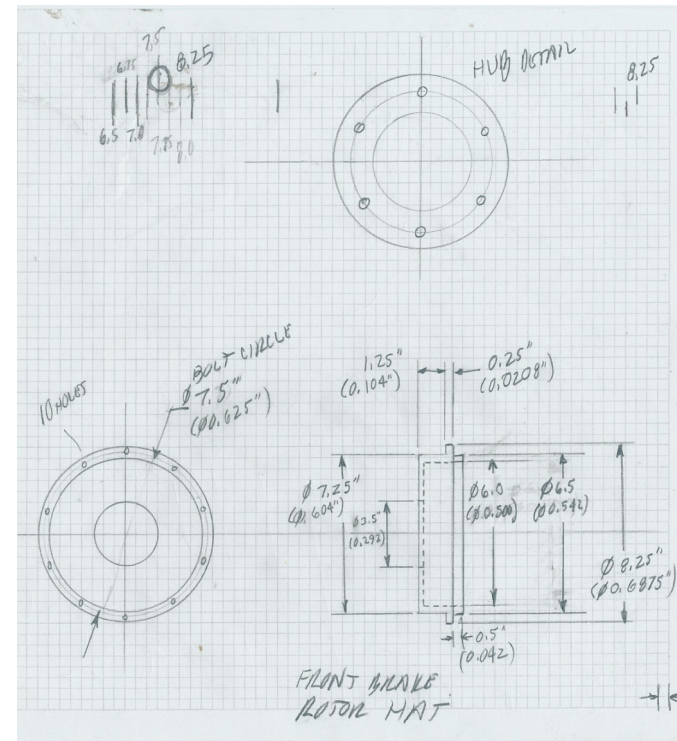


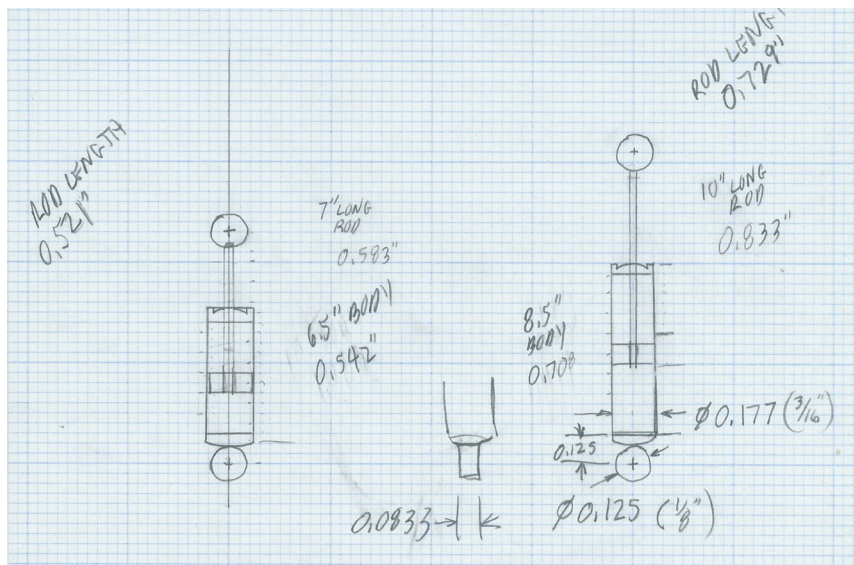
Front and rear hubs were a special challenge, as they needed to be threaded to accept the knock-offs that hold the wheels on. On the full-size cars, these hubs and knock-offs are threaded using a right-hand thread on the left side of the car and a left-hand thread on the right side of the car. This is done so the driving and braking torques coming through the wheels tend to tighten the knock-offs, not loosen them. These threads are 1/8" in pitch in full-size, which translates to 1/96" inch in scale or 96 threads per inch. After making numerous drawings and grinding a special cutting tool, the threads were cut onto brass sleeves installed on the aluminum hubs. The inside threads for the knock-offs were machined inside brass rings. These rings were then insert-molded into resin knock-offs for added strength.





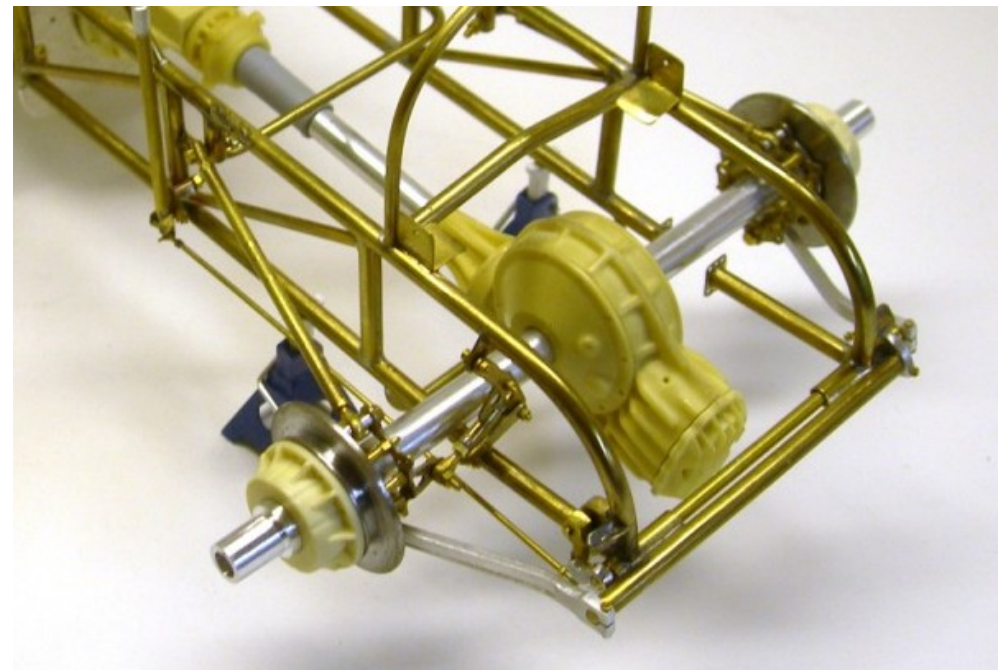
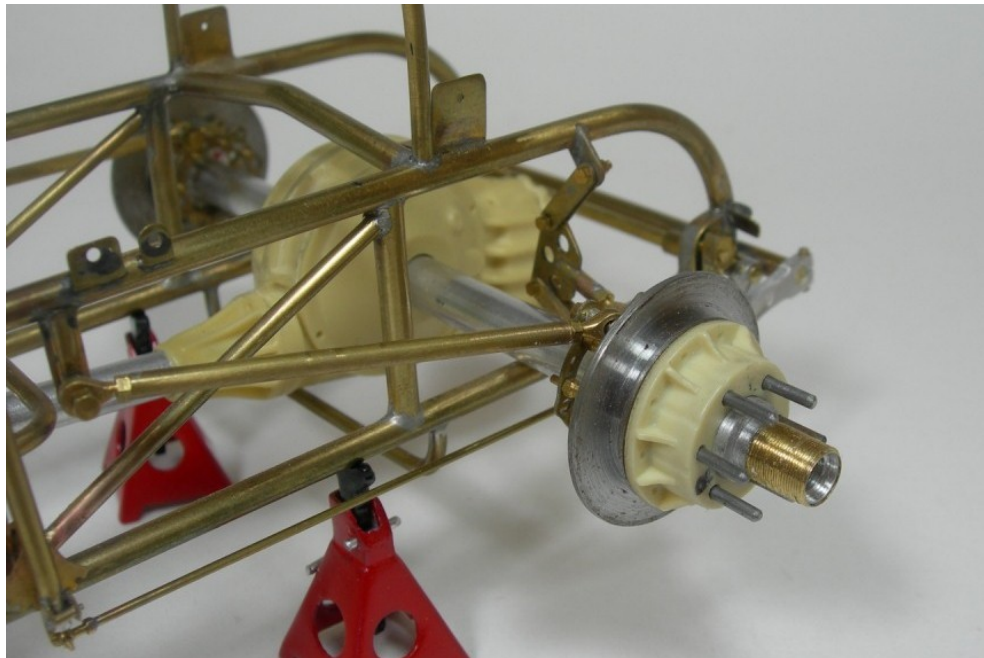
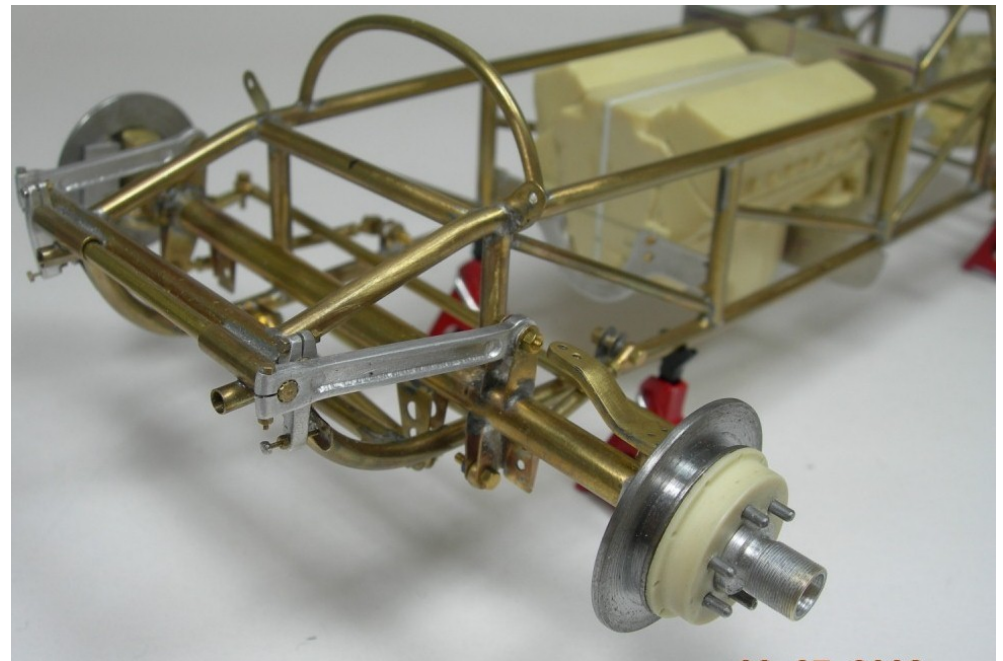
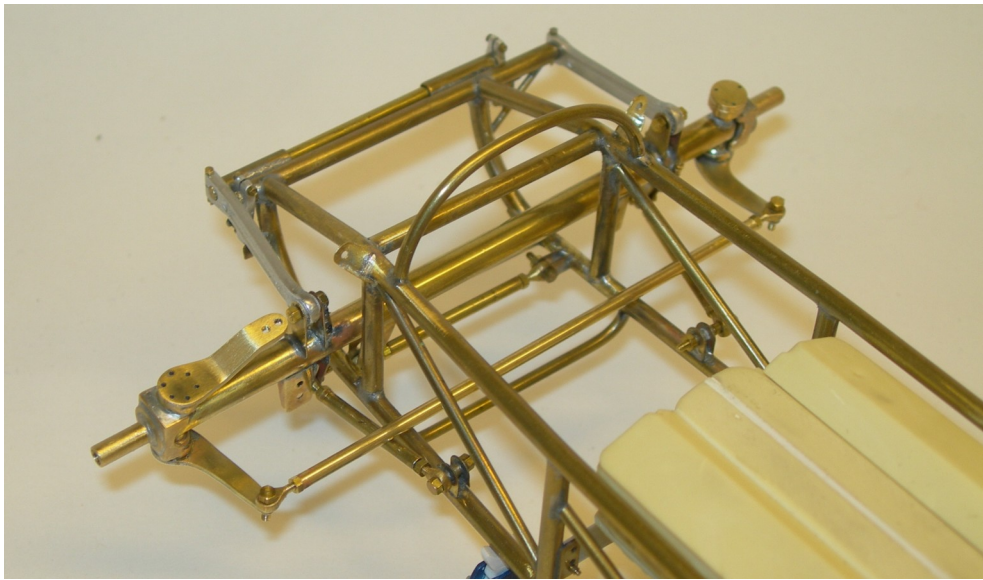
Drawings were also made for the rear hub/brake assembly as well as the front and rear rotors/hats. I find it much easier to spend the time to do the engineering up-front; not when I'm trying to machine or fabricate the part. That way I know when I am finished with the part, it will be the right size and everything will fit. It also saves a lot of time in the end, as it is easier to erase and redraw a couple of lines on a drawing than it is to remake a complicated part.



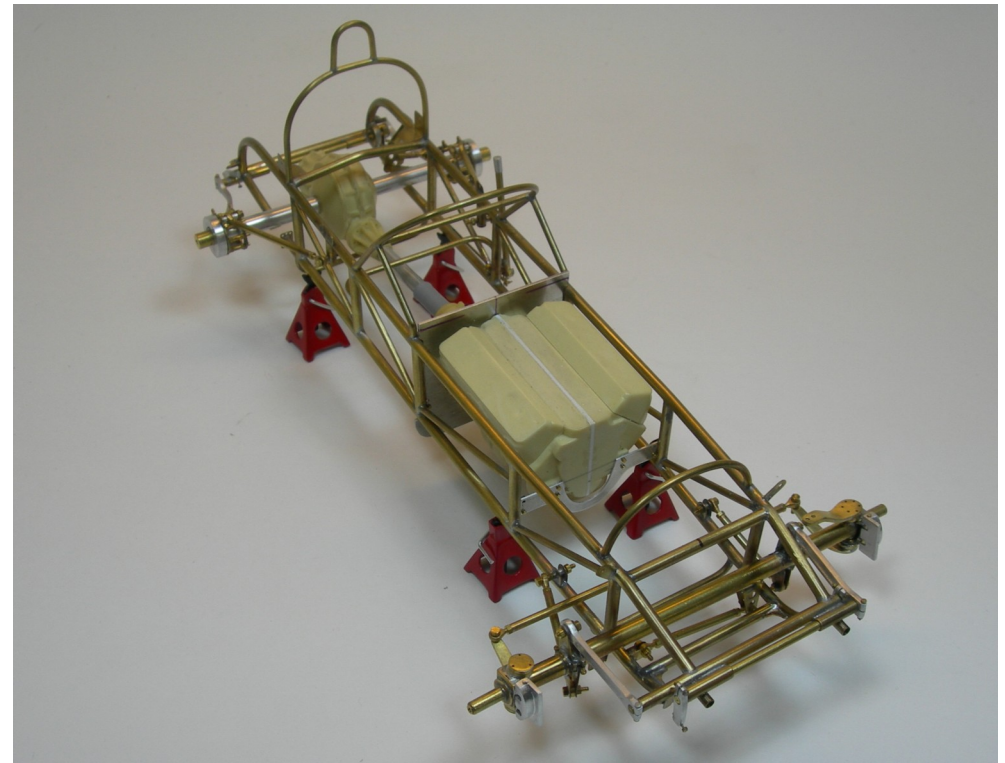
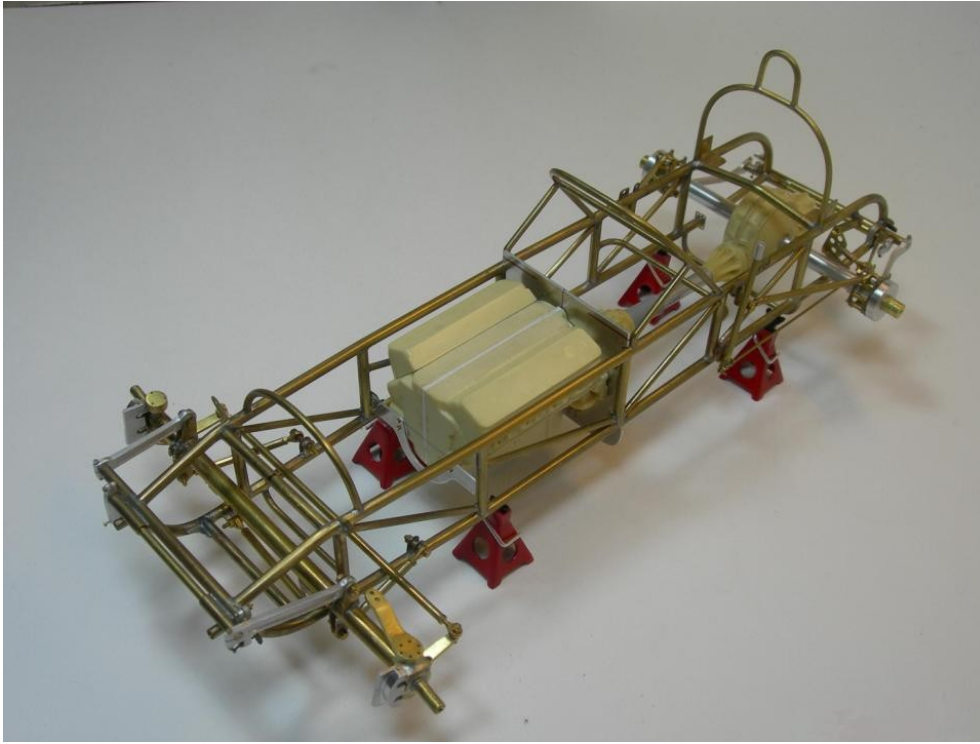


Front and rear shock absorbers were designed and built using brass tubing for the bodies and mounting rings. Stainless steel tubing was placed over brass rod to replicate the chromed rods, with brass pistons fitted with plastic bands. The calipers were mastered from styrene and cast in resin. Later, these would be detailed with machined aluminum pistons and brass fittings.

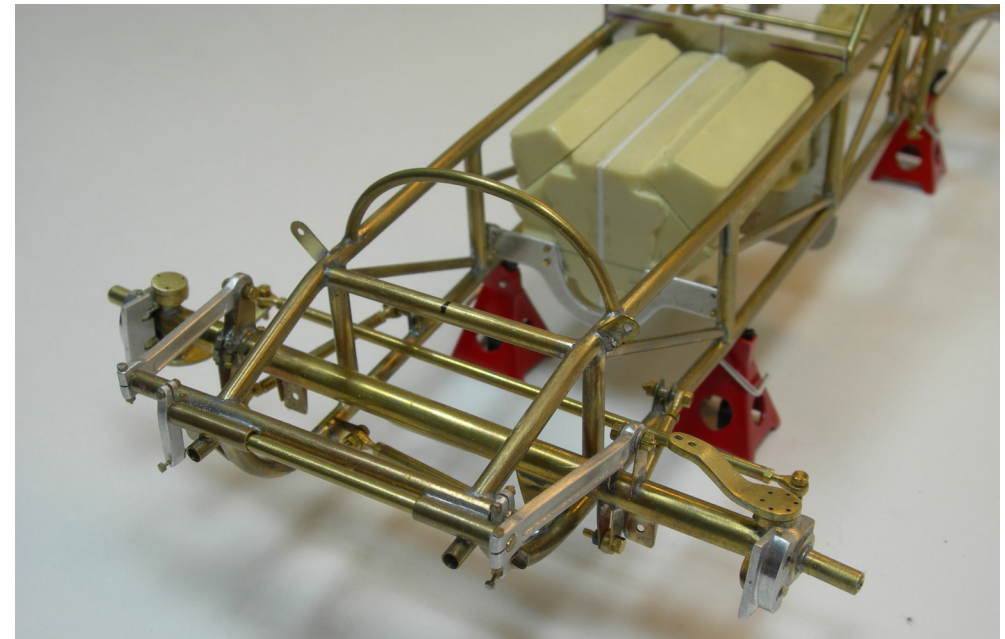


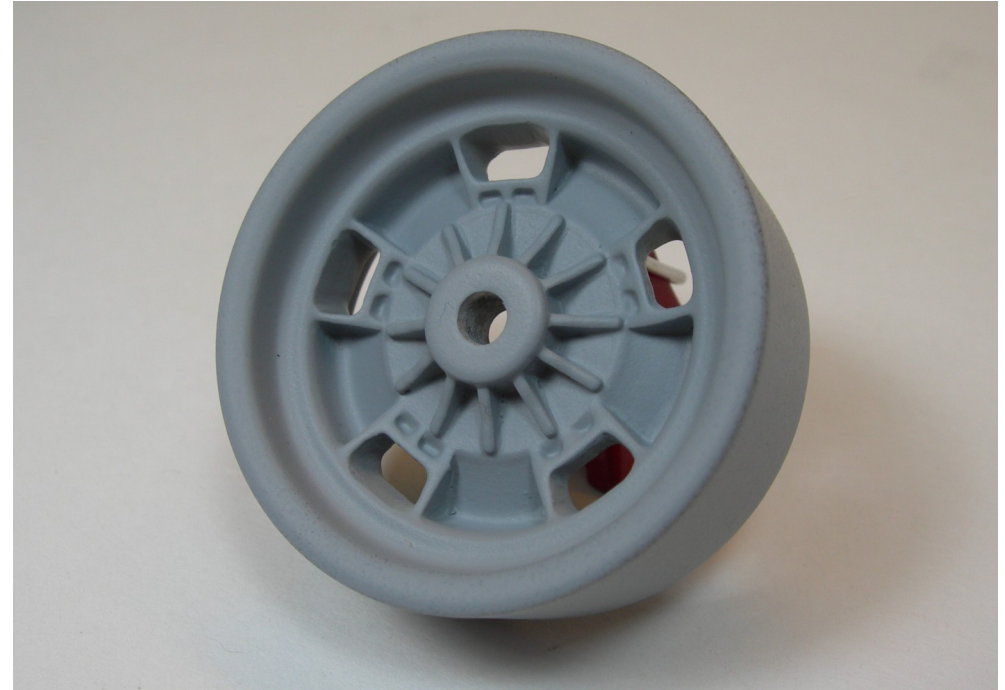
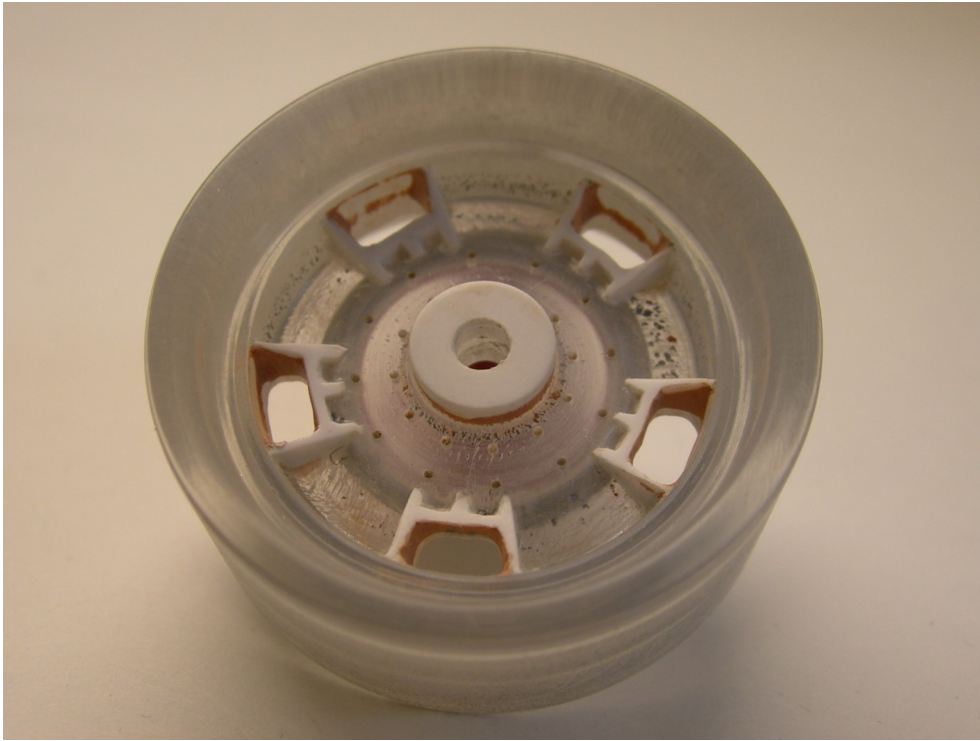


With the front and rear suspensions completed, it was time to turn my attention to the wheels and tires.



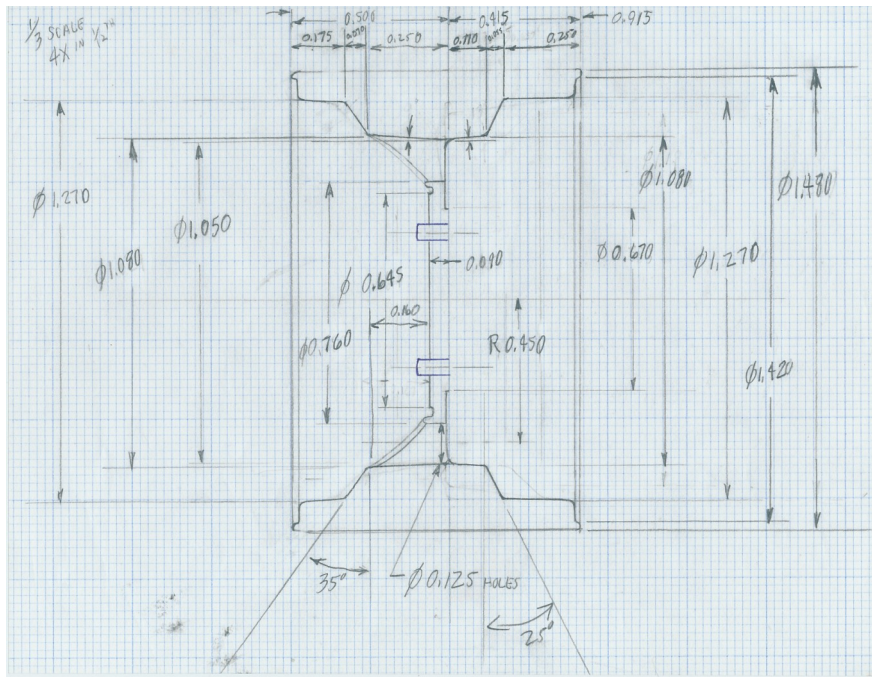
At this point in the project, I was making good progress and things were coming together nicely. Little did I know I was only 18 months into what would turn out to be a five year project. As they say, ignorance is bliss!





The master for the front wheel was made from Plexiglas and styrene and then duplicates were cast in resin. These were then drilled for the center locator and drive pin holes.





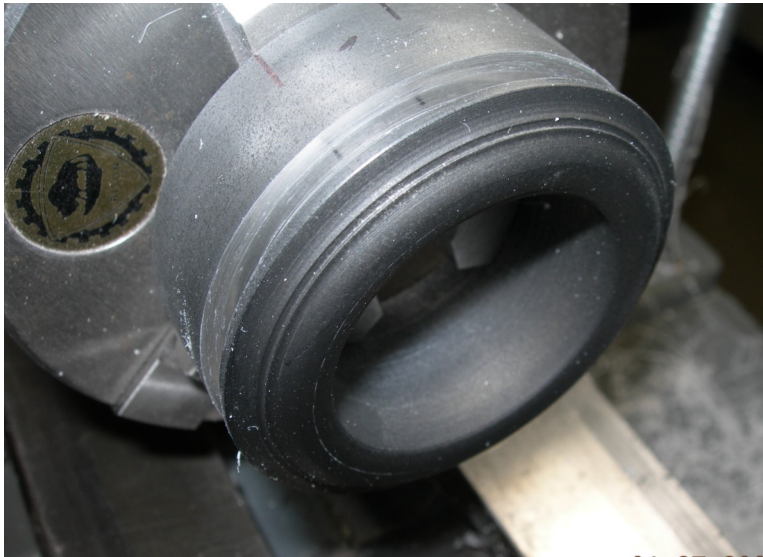
The master for the rear wheels was made in the same manner as the front, but was a more complicated shape and took several tries to get it right. The beginnings of the rear tire master is also shown in the photo to the right.



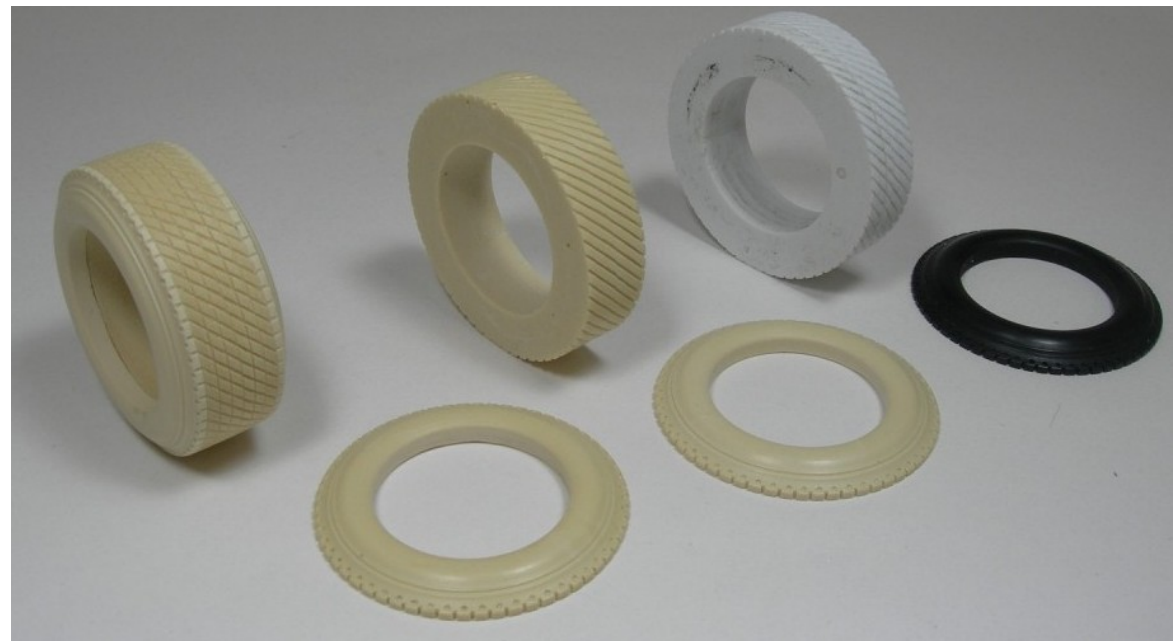


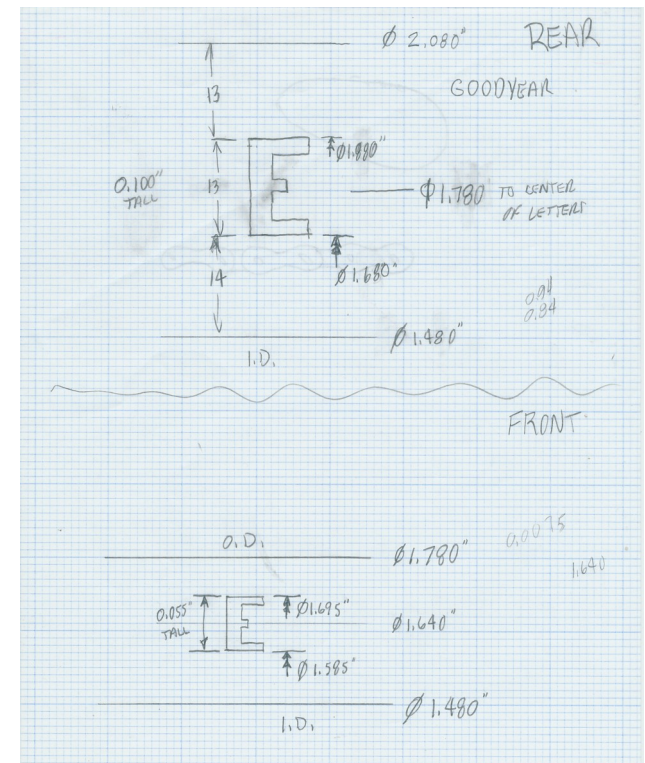
The master for the front tire was machined from Plexiglas and the diamond side wall details were heat-staked into the plastic. An RTV mold was then made of this one-half tire shape and resin copies made. These were machined to a specific thickness and joined using CA glue. Rib tread rings were then machined into the tread surface.



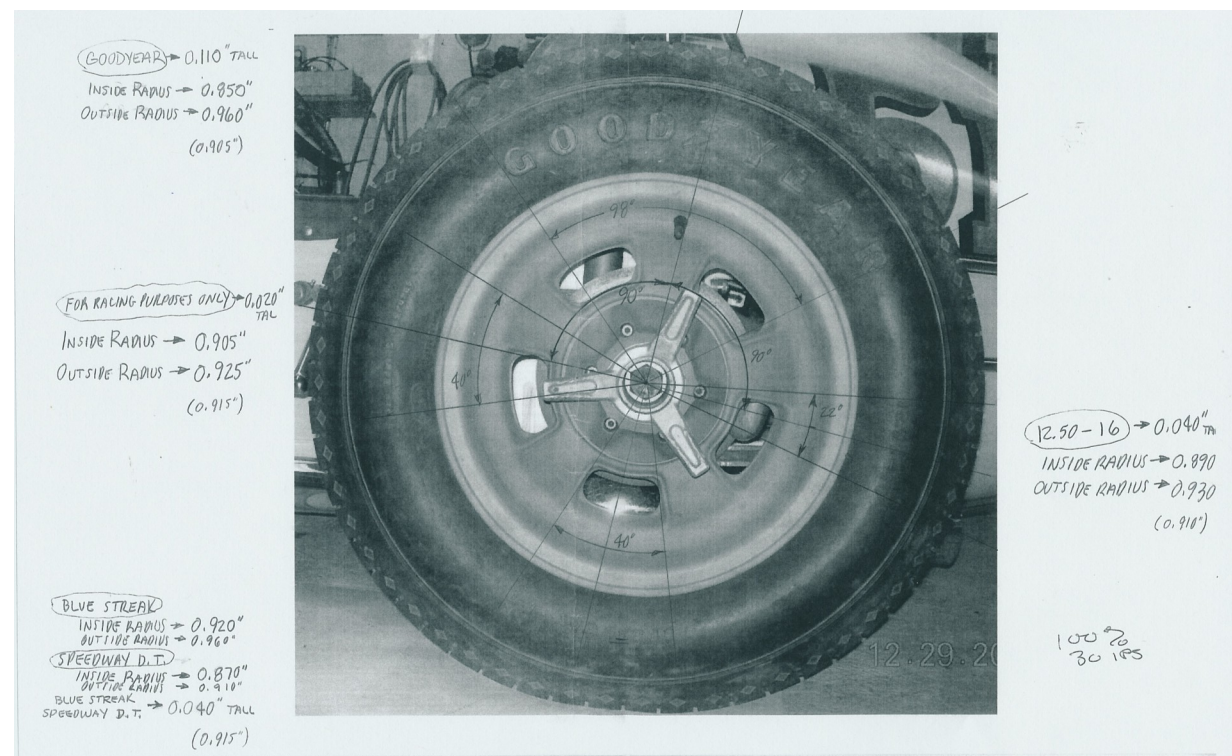


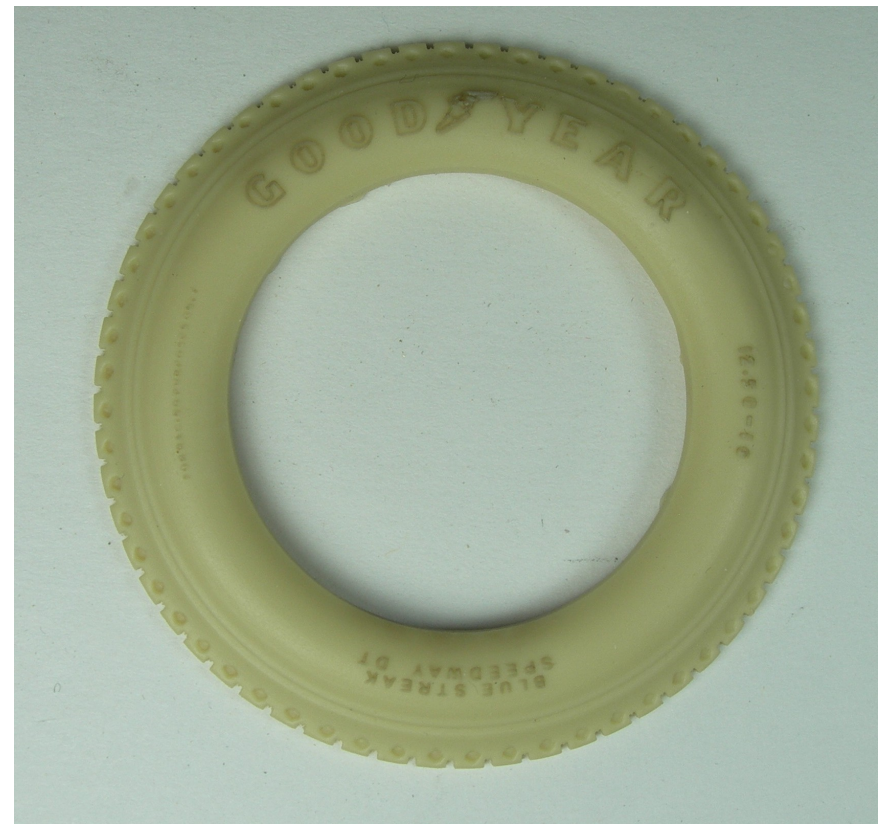
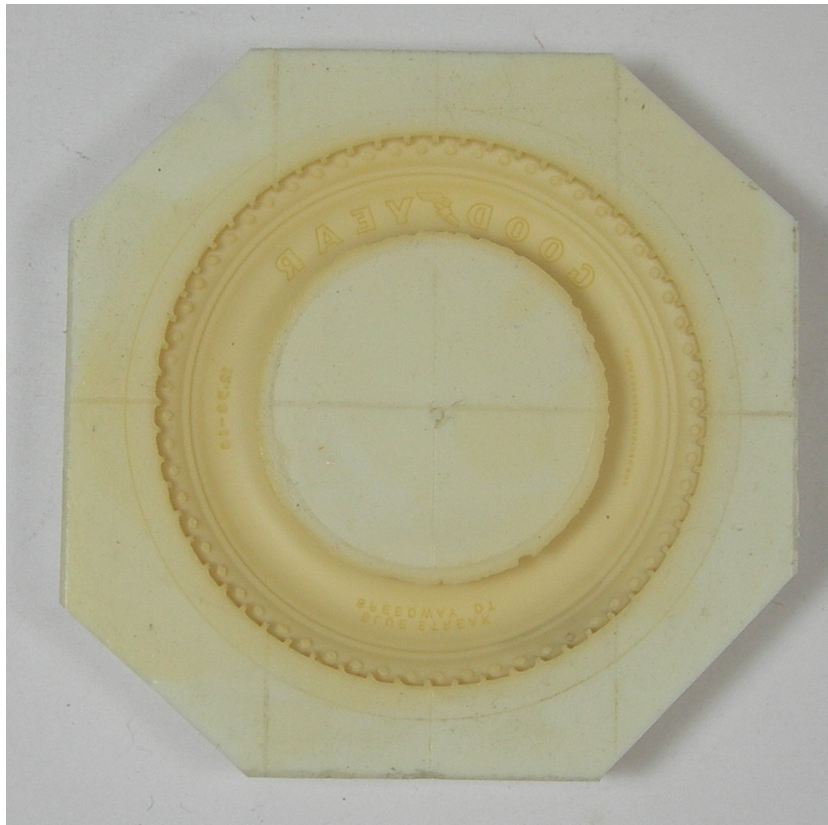
Construction of the rear tires, while similar to the fronts, was a bit more complicated. Instead of using two identical halves, the rear tire consists of two identical sidewalls attached to a center tread-ring. The sidewall master was machined from Plexiglas, and the tread block sipes were cut using a small saw cutter. The diamond-shaped indentations were heat-staked the same as the front tires. The center tread ring was made from six separate rings, each cut with the diagonal pattern of the tread using the lathe headstock as a dividing fixture, and then joined together to form a single piece. The diagonal cuts were then cleaned up using a razor saw, and RTV molds were made of the tread ring and sidewall masters. Resin copies were made of the sidewalls and tread ring, and then these three pieces were joined using CA glue. Circumferential rings were then cut into each tire "assembly" using a 0.015" cut-off tool to form the individual tread blocks.





Now with the basic tire shapes completed, it was time to add the sidewall lettering. This was accomplished by first scaling the size of each marking from photos of the tires. These photos were also scanned into Corel Draw and the "Goodyear" lettering isolated from the image, cleaned up and enhanced. This artwork was combined with the rest of the tire info, reversed to a mirror image, then saved as a jpeg file.



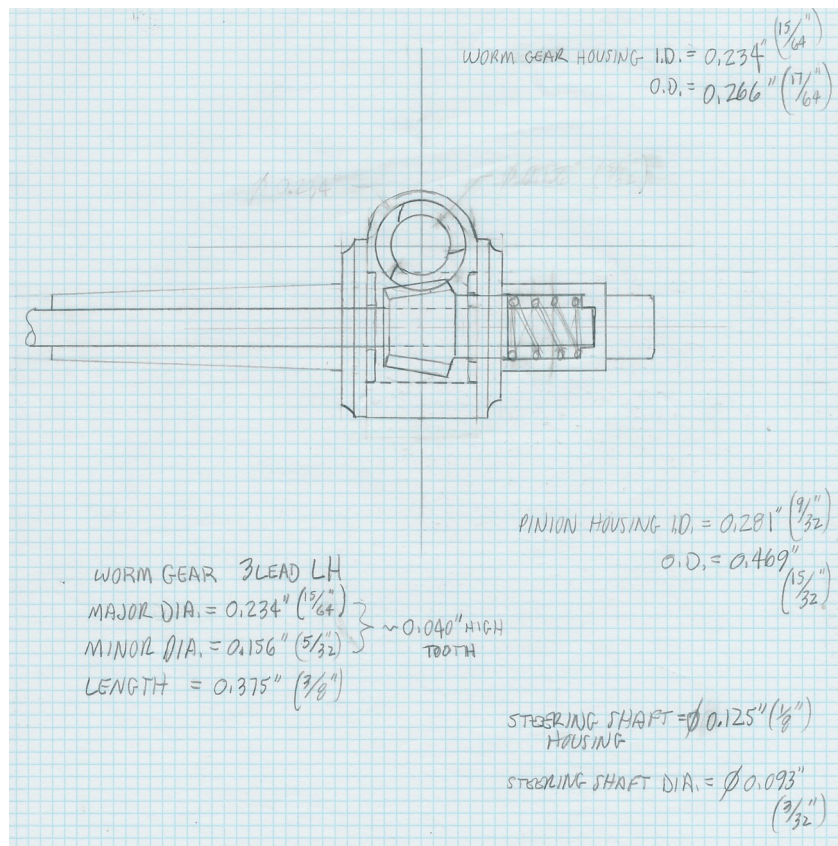


This sidewall detail was then engraved (still in the mirror image) into the RTV tire sidewall molds using a 600 dpi laser engraver to "print" those jpeg files. Some experimentation was needed to establish the correct intensity for the laser, as this determined the depth of the engraving, which translated directly to the height of each raised character on the final resin casting. Surprisingly, this method of achieving the tire detail worked out better and easier than expected. It was one of those rare times when things actually work the way you think they should!

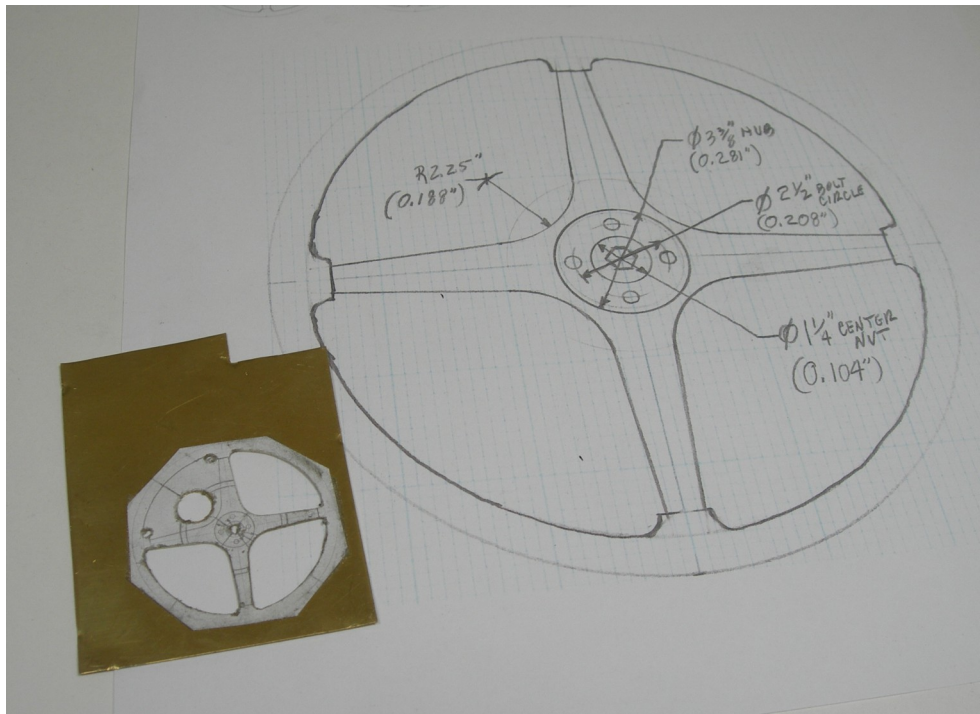




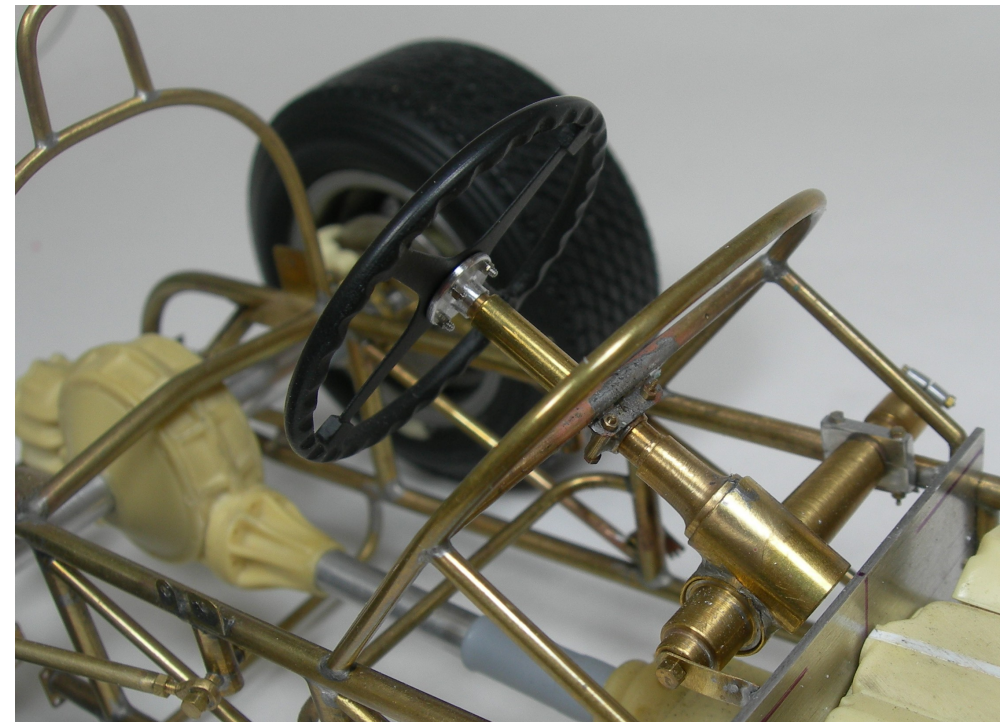
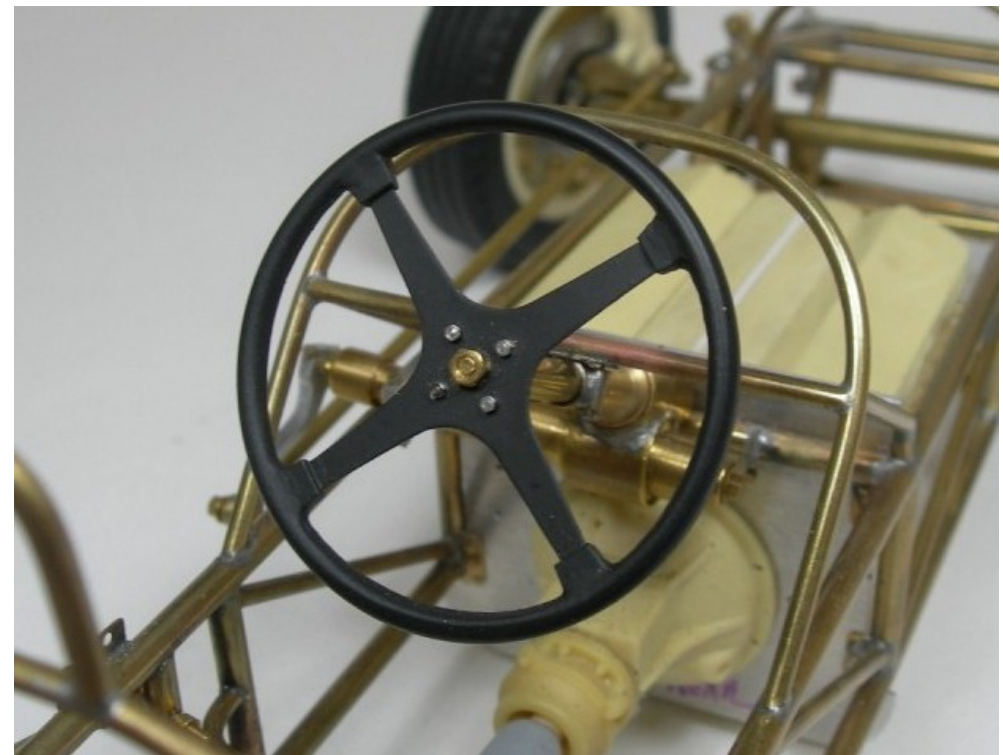
With the tires and wheels finished, the car sat on this own four corners for the first time; nearly two years after the project began. I don't know about you, but I always get excited when I see my project vehicle finally on its wheels!

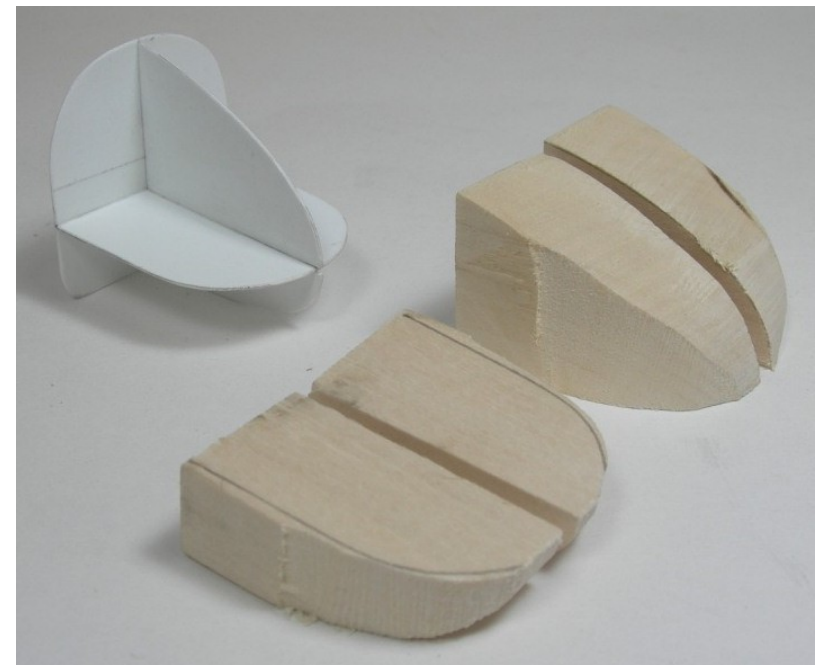
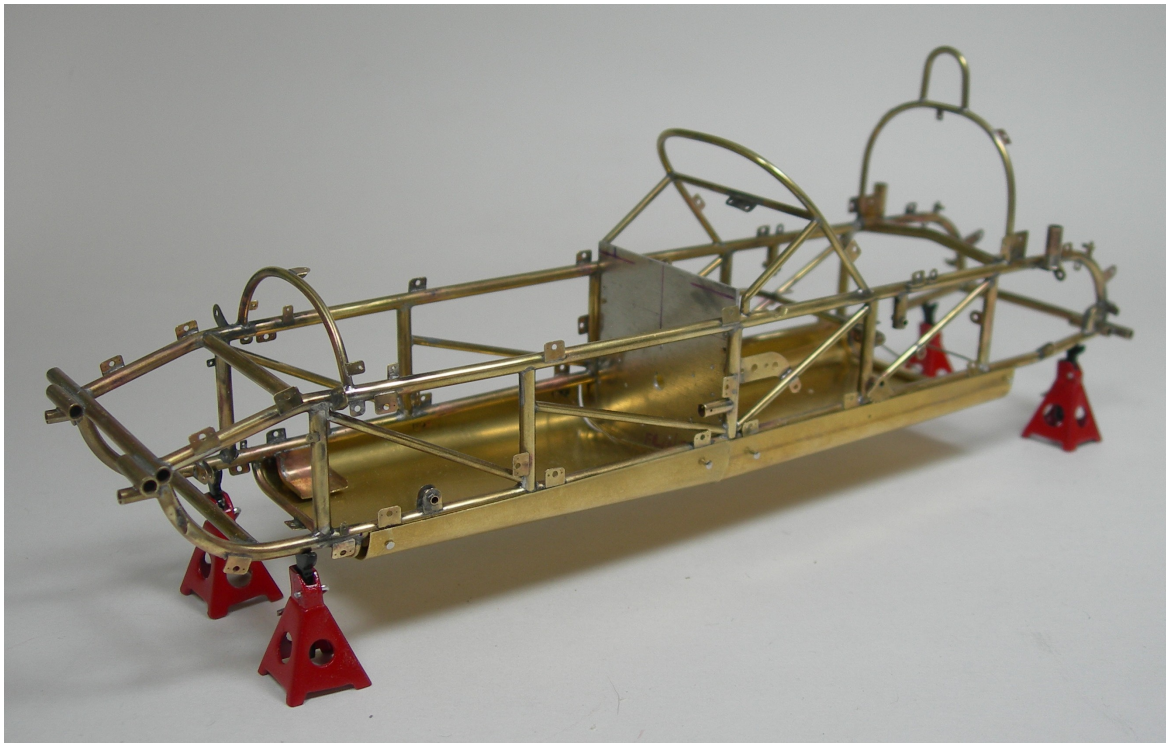


Since the vehicle now had wheels, it seemed like a good time to build the steering box, so those front wheels would have some directional control. I really had no idea what the steering ratio was for a racer of this type, so a return trip to the race shop was needed to find out. A quick lock-to-lock turn of the steering wheel confirmed the steering ratio to be 4:1. The length ratio of the spindle steer arm to the steering gearbox arm was 1.25:1 meaning the steering gear itself needed to be a 5:1 ratio box. The relative direction of rotation for those two arms also meant the steering gear had to use a left-hand thread on the worm inside the box. A few scale concept drawings were made to determine the size of the worm gear and sector gear, and after a few more calculations, I settled on using a 3-lead, left-hand thread worm gear working on a 15-tooth sector gear. The steering gear box itself was made from several pieces of brass tubing soldered together to form the body structure. This basic housing would later be detailed using styrene plastic and resin castings to give it the correct outward appearance. The worm gear was made by winding 0.032" brass wire into a coil spring and stretching it to give the correct spacing between the coils. Three equal lengths of this spring were then cut, intertwined, and soldered in place on the outside of a piece of brass tubing to form the 3-lead worm gear. The sector gear was machined from brass rod, and the teeth cut using a rotary saw cutter and the lathe headstock for a dividing table. These two gears were soldered onto appropriately sized brass rod/tube shafts and the gear box was assembled. Prior to soldering the box together permanently, the gear set was packed with toothpaste; then run-in using a hand drill to mesh the gears and knock down any burrs or high spots so it would turn smoothly.



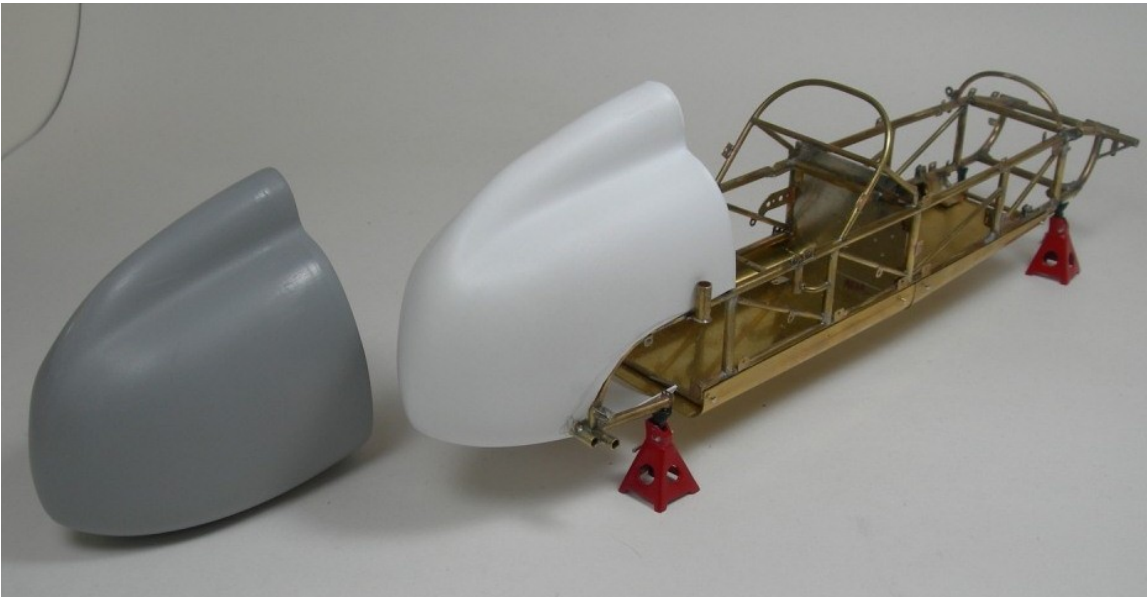
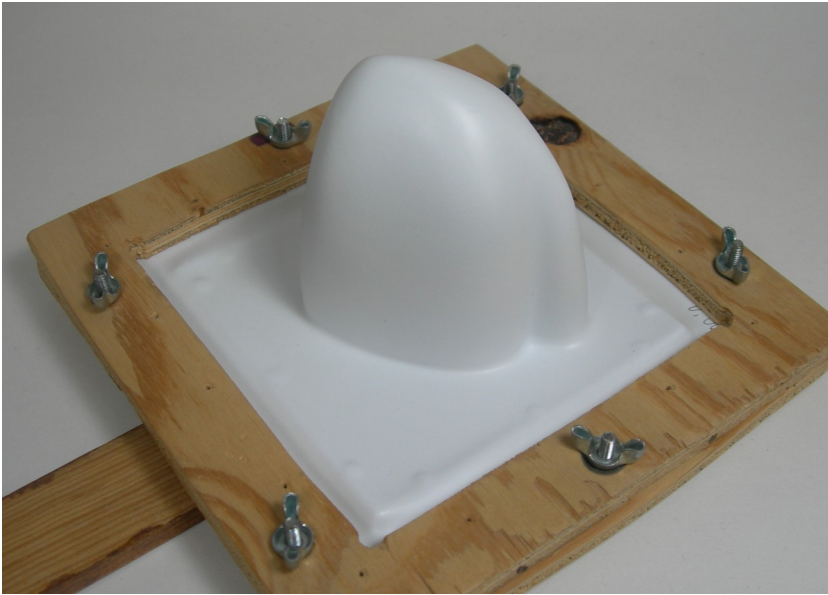
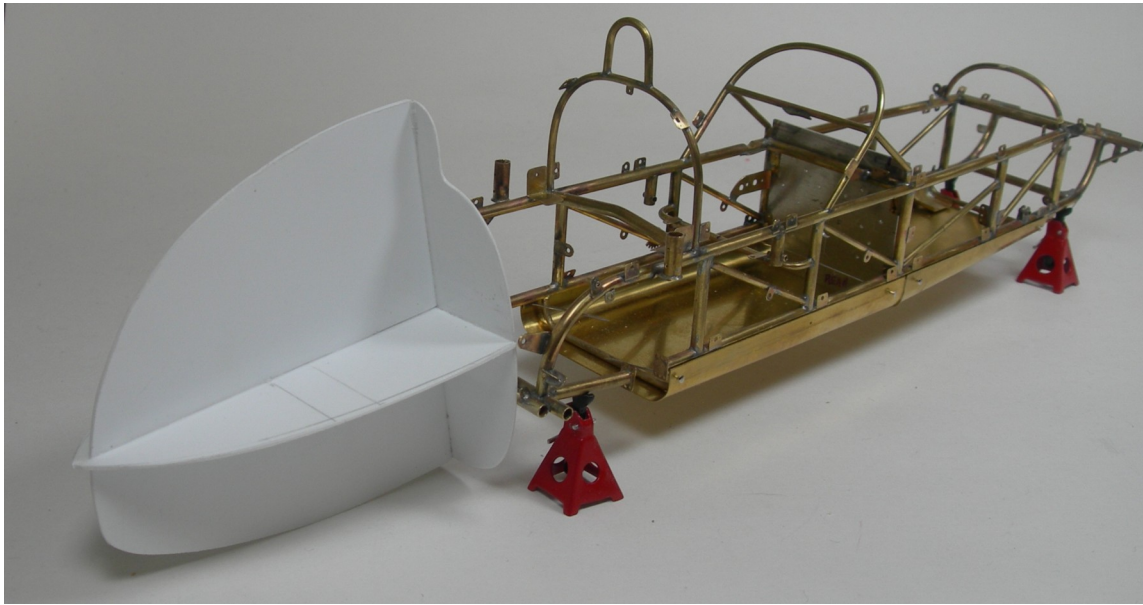
Steering wheel spokes were laid out to scale, and this drawing was scanned and printed out in 1/12th scale. This image was attached to a piece of 0.015" brass sheet with double sided tape, and the openings between the spokes were drilled and filed to shape. Two rings of Plexiglas were machined and glued together on either side of the spoke piece to form the grip. This was turned in the lathe to the final round cross-section and the finger grips machined in with a rotary cutter, again using the lathe headstock as a dividing table.

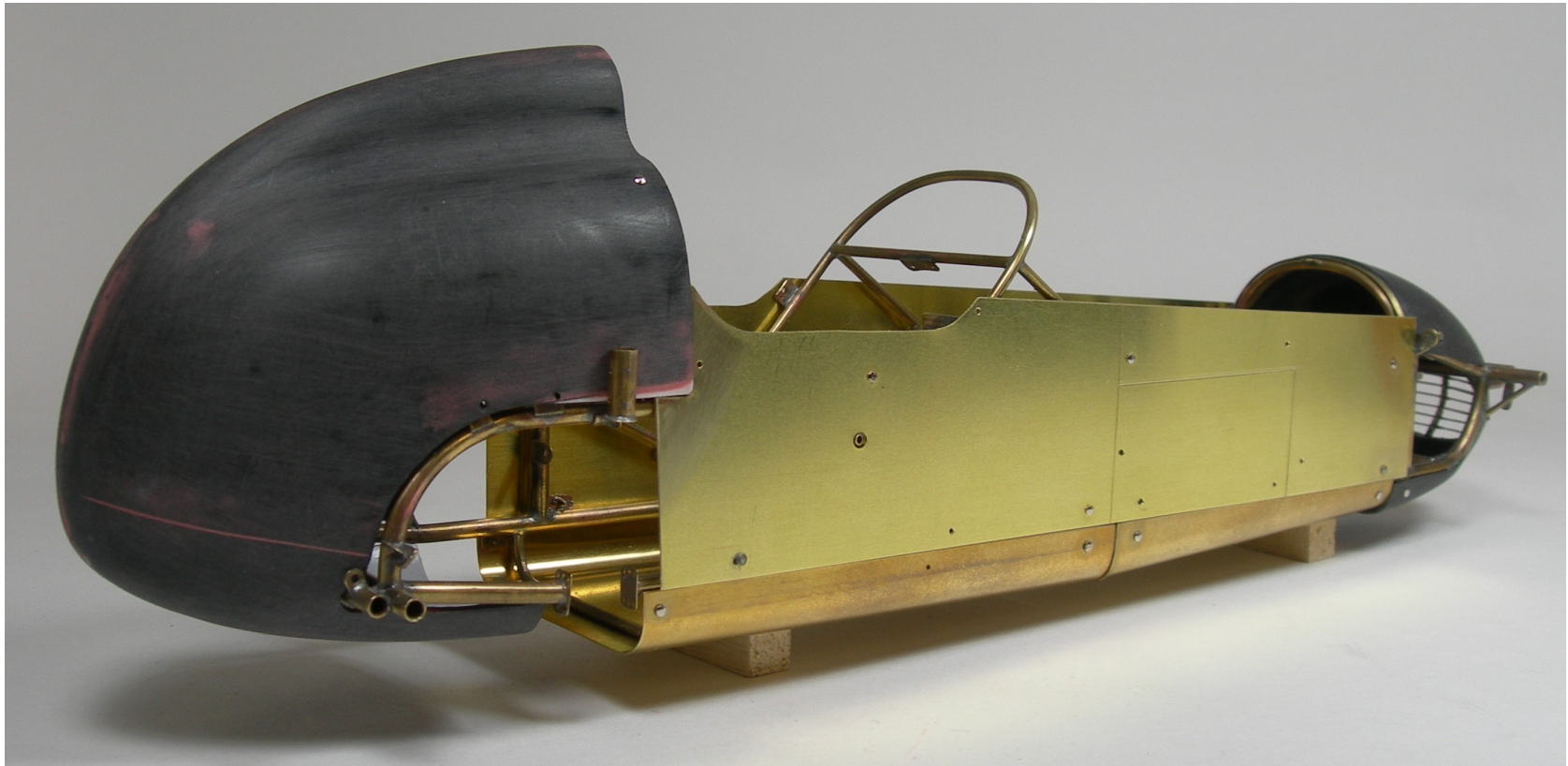
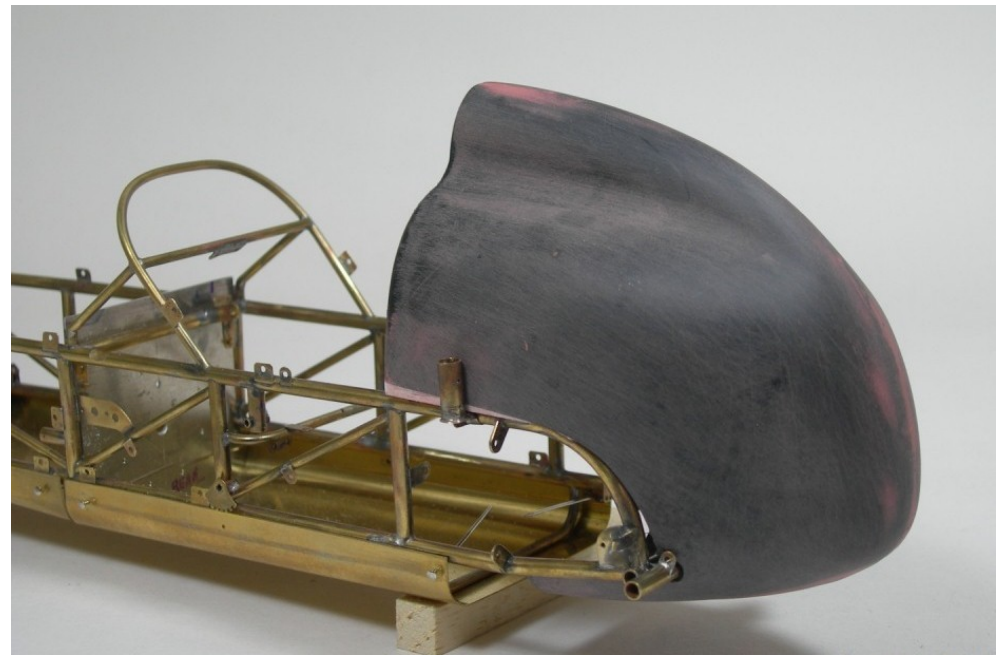
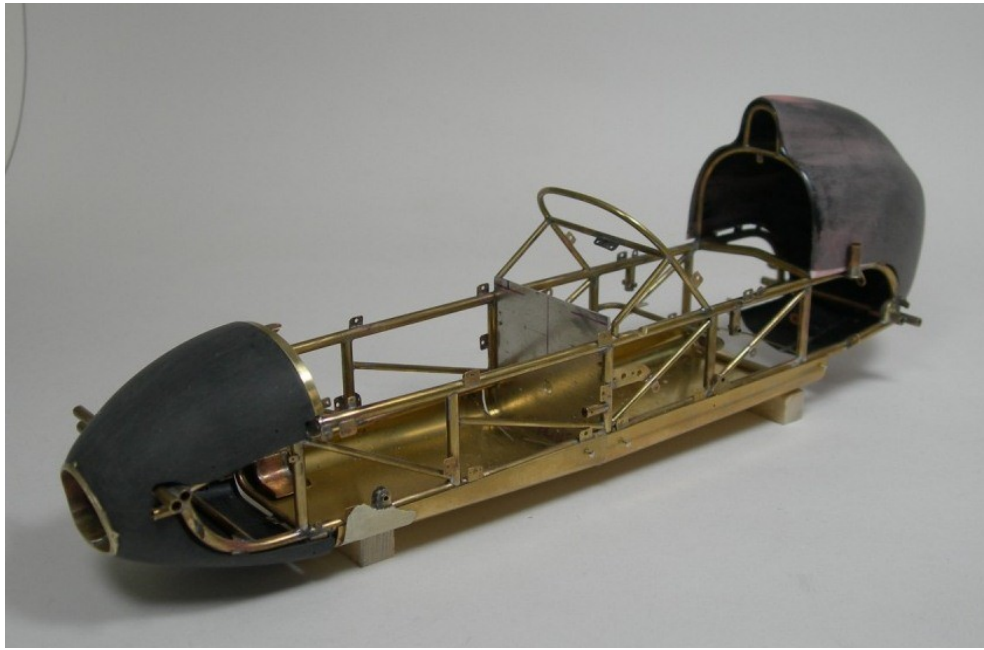


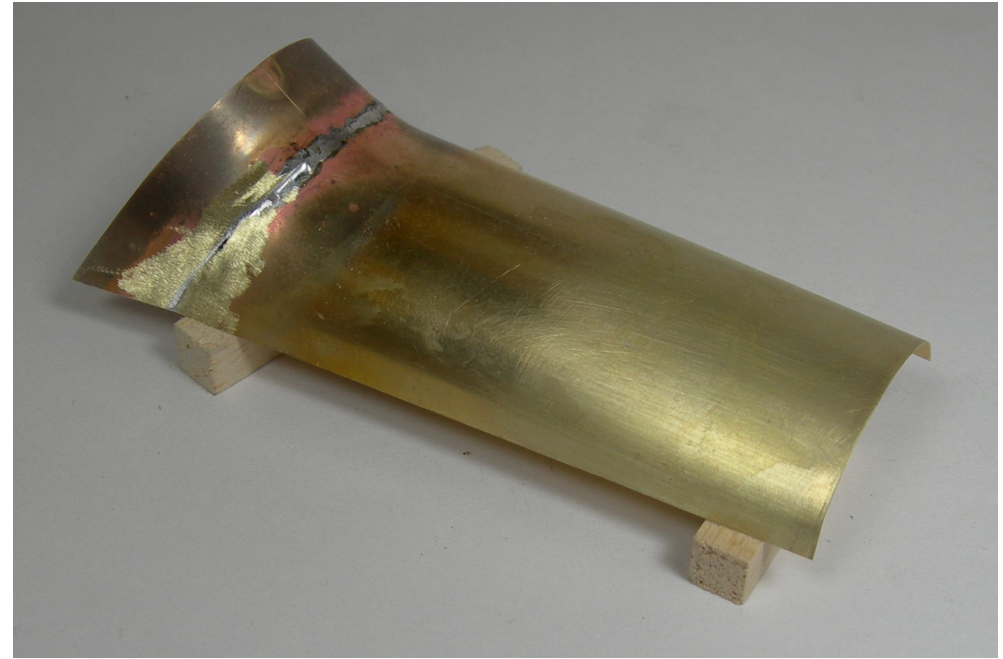
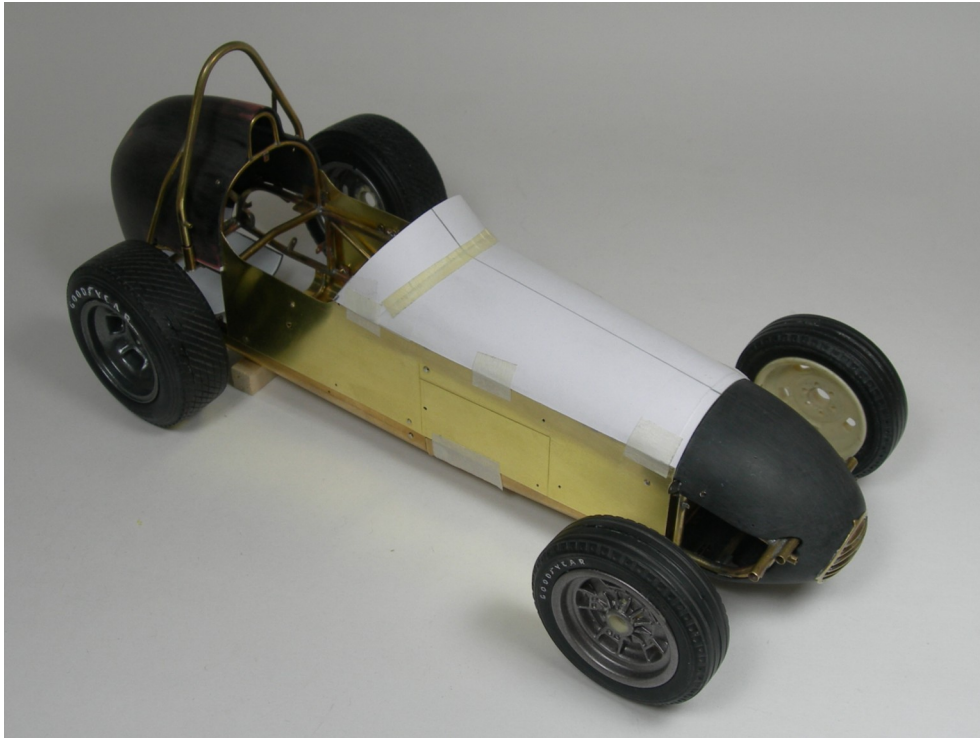


With the majority of the chassis now completed, it was time to start forming the body panels. The belly pans and side panels were relatively straightforward to make from 0.010" brass sheet, but the nose and tail required a different method. To make the bucks for these two pieces, sheet plastic templates of the front, top, and side views of the nose and tail were created. These were joined in an egg-crate manner to form a "spine" of the basic shape. The spaces in the egg-crate were then filled using basswood and the final shape carved/sanded using the plastic spines to guide the removal of the excess basswood. Once these were at the final shape, putty and primer was applied to fine-tune the contours. These body bucks were then used to vacuum-form the nose and tail pieces from 0.060" styrene plastic sheet.

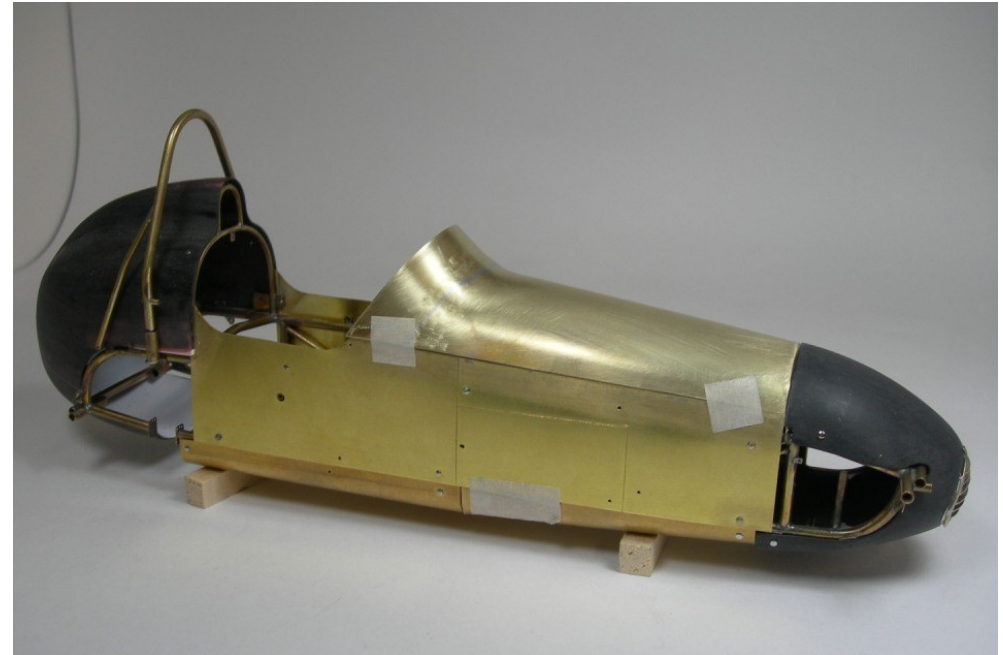


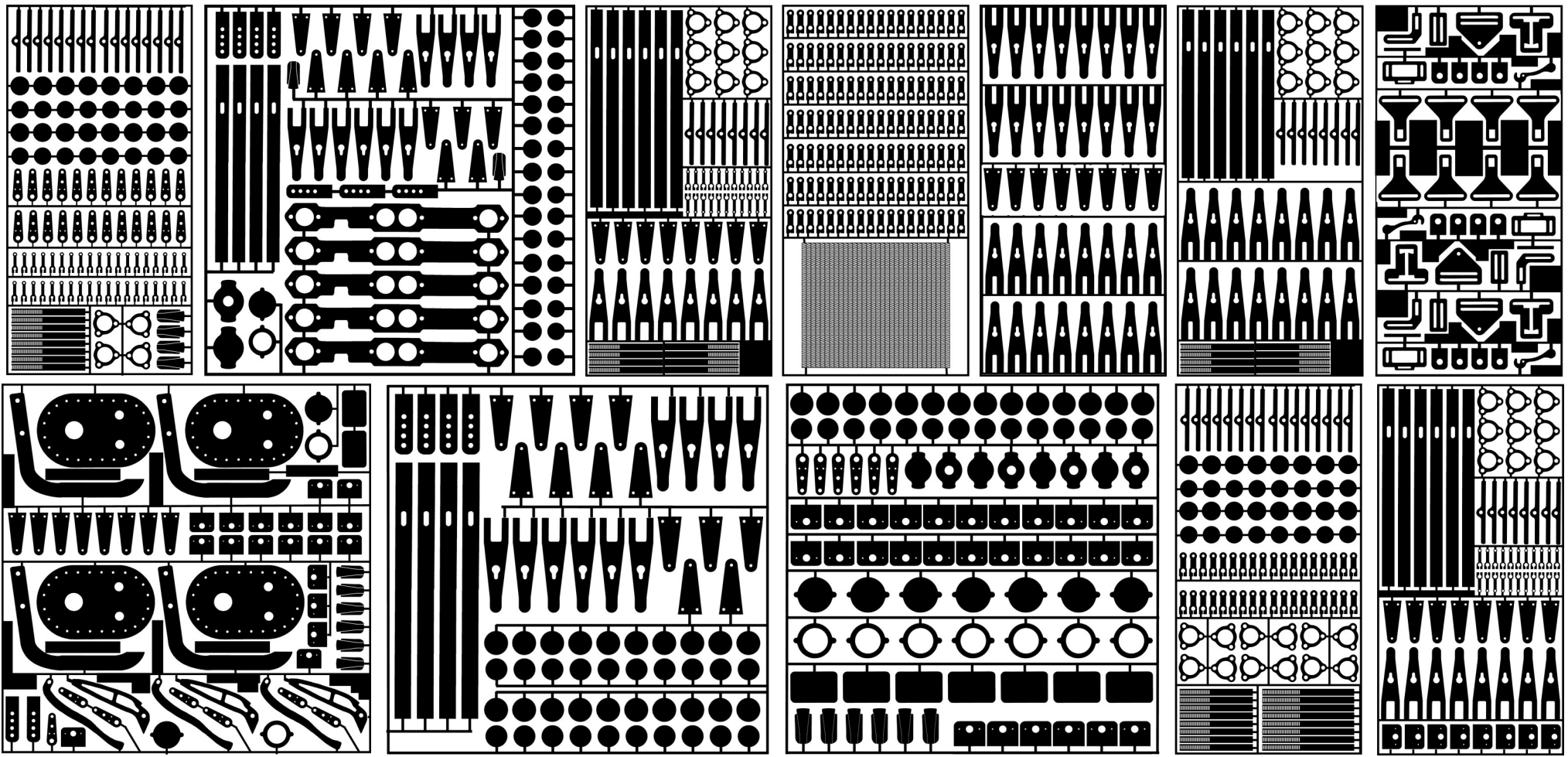






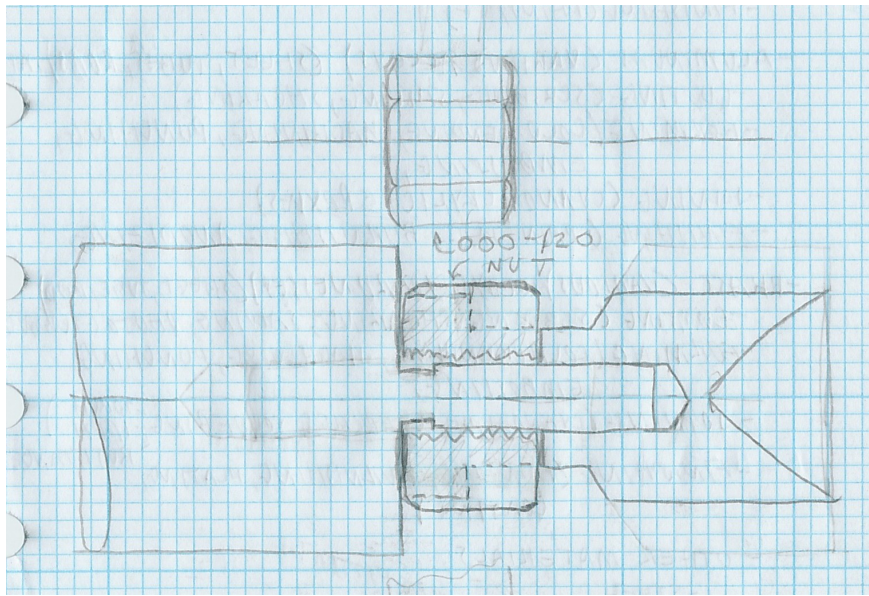
The hood was also formed from 0.010" brass sheet, but it required some additional metal-working to form the kick-up at the windshield. An additional piece was needed for this shape and it was soldered in place. Annealing the brass with a small butane torch prior to forming made this step a bit easier.



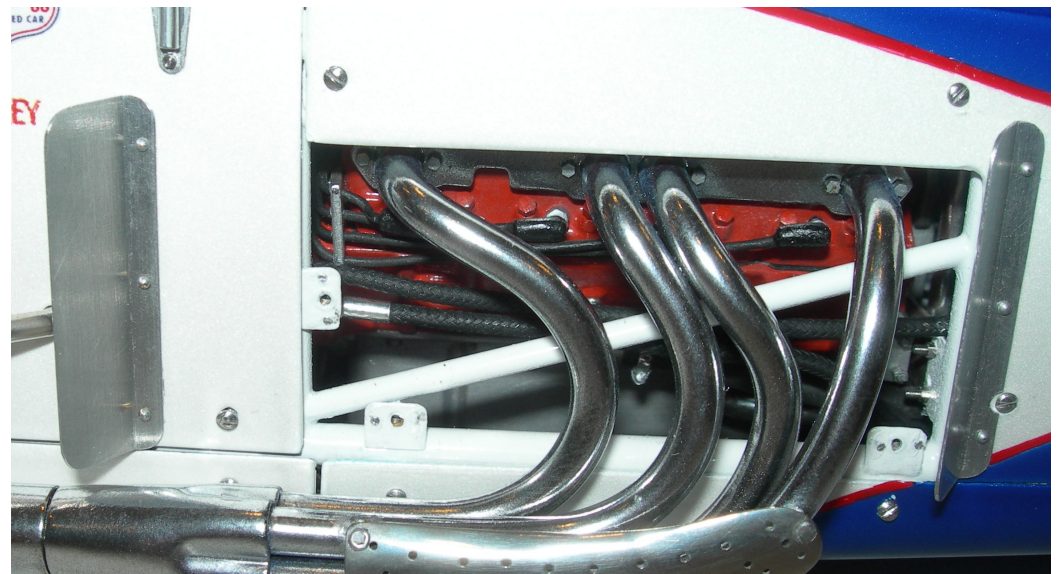
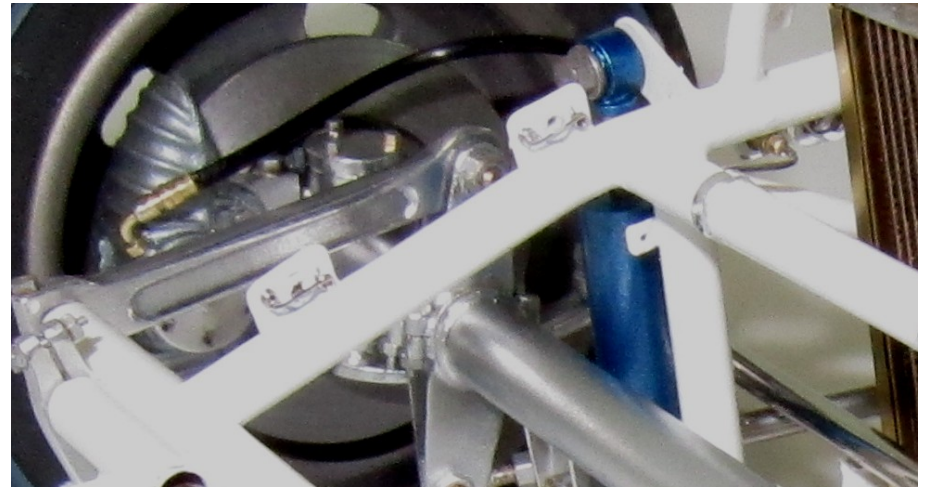
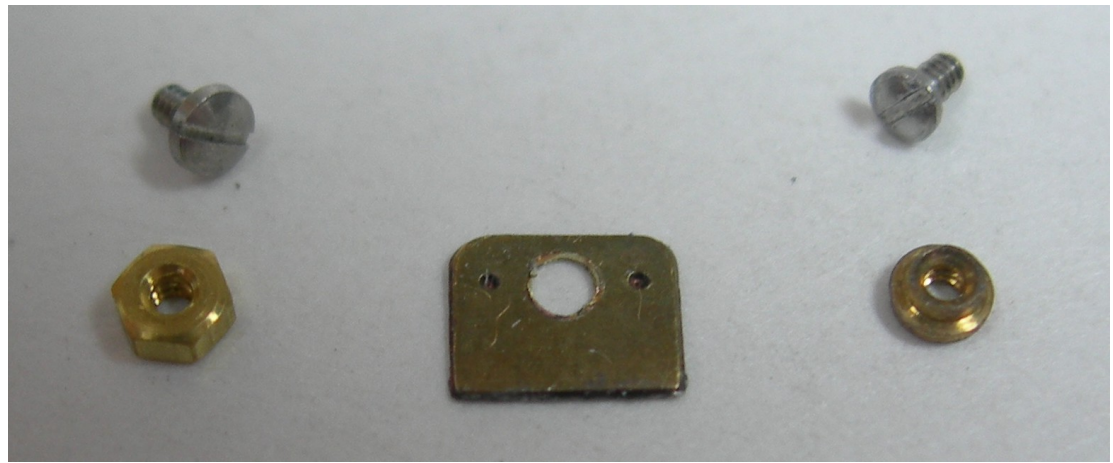


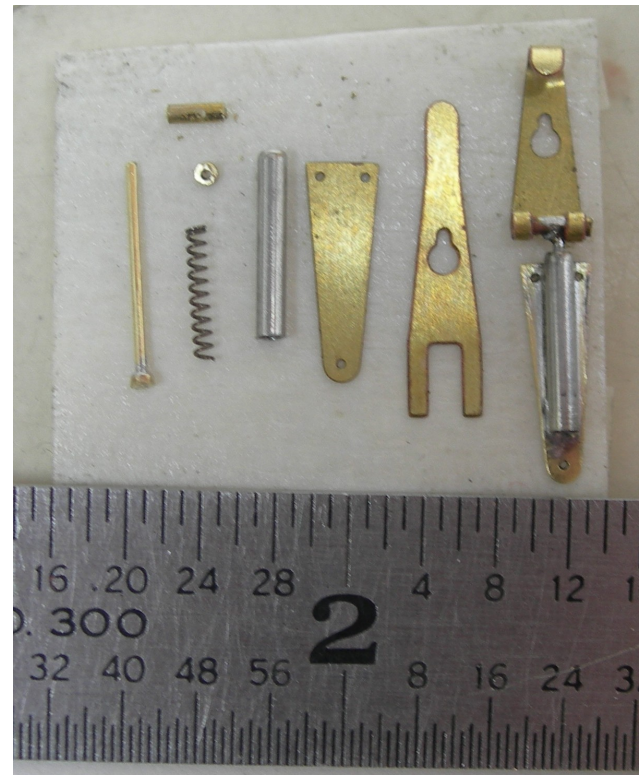
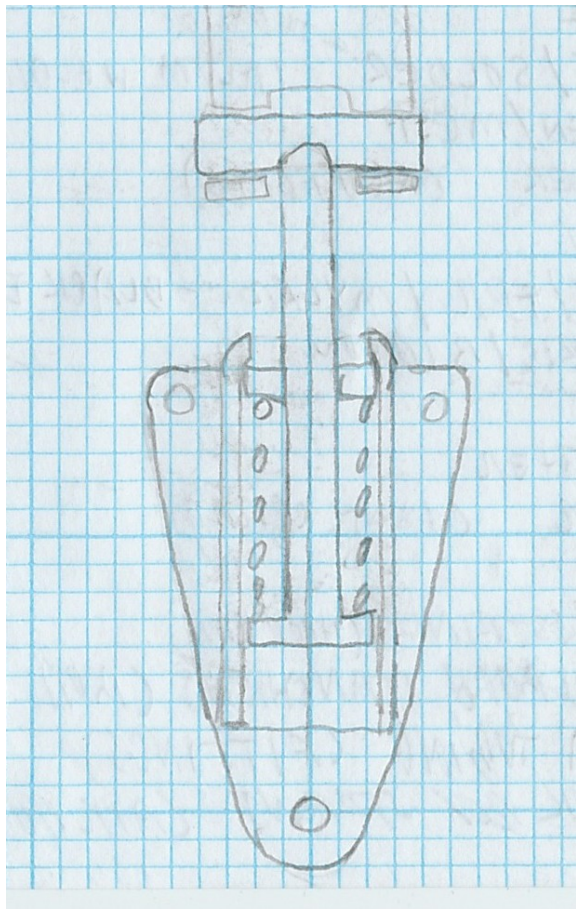
By now I needed quite a few additional photo-etch parts, so I created artwork again using the previously described process, but instead of sending it out for etching, I made my own using the Micro-Mark Photo-Etch System. I was able to etch both brass and stainless steel, up to 0.010" thick, and the quick turnaround helped keep the project moving forward. Here is all of the various artwork I created over the last part of the project to complete the model and an example of the frets ready for etching. Some of these parts were never used on the model, but it was great having the flexibility to make my own photo-etch when I needed it.





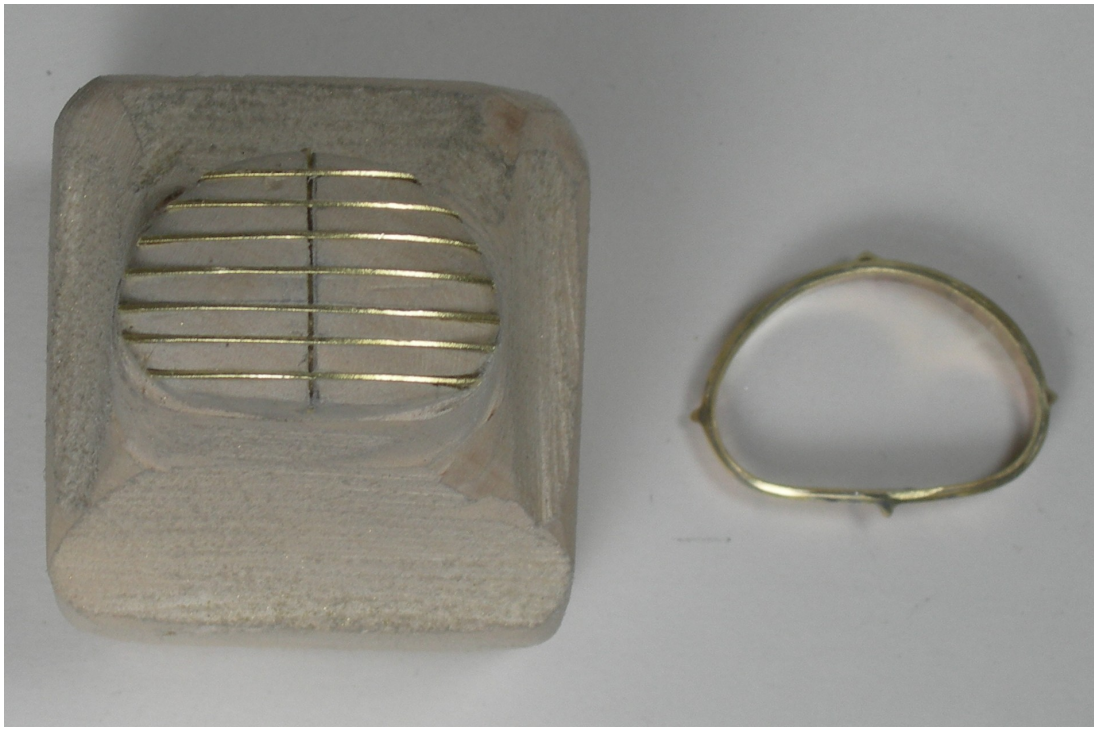
Attaching the body panels to frame required some means of replicating the quarter-turn Dzus fasteners used on the full-size car. These were accomplished using photo-etched plates soldered to the frame. The quarter-turn fasteners were duplicated by machining the heads of 000-120 stainless steel pan head screws into a smaller, more rounded shape. 000-120 brass nuts were machined into a T-nut shape and soldered into the back of the photo-etched plates to provide a threaded receptacle for the screws. The S-shaped retainer springs of the full-sized fasteners were duplicated using 0.006" wire wound around a special fixture and then attached to the plates after the frame was painted. All body panels can be removed and reinstalled using the sixty-plus individual fasteners on the car.



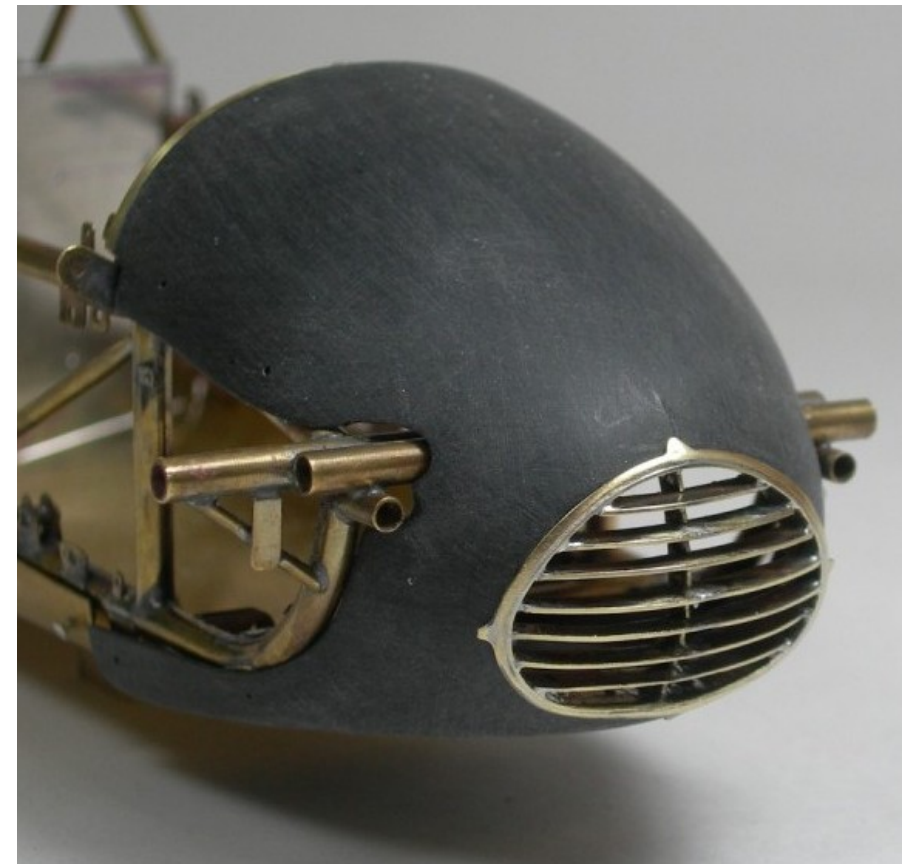


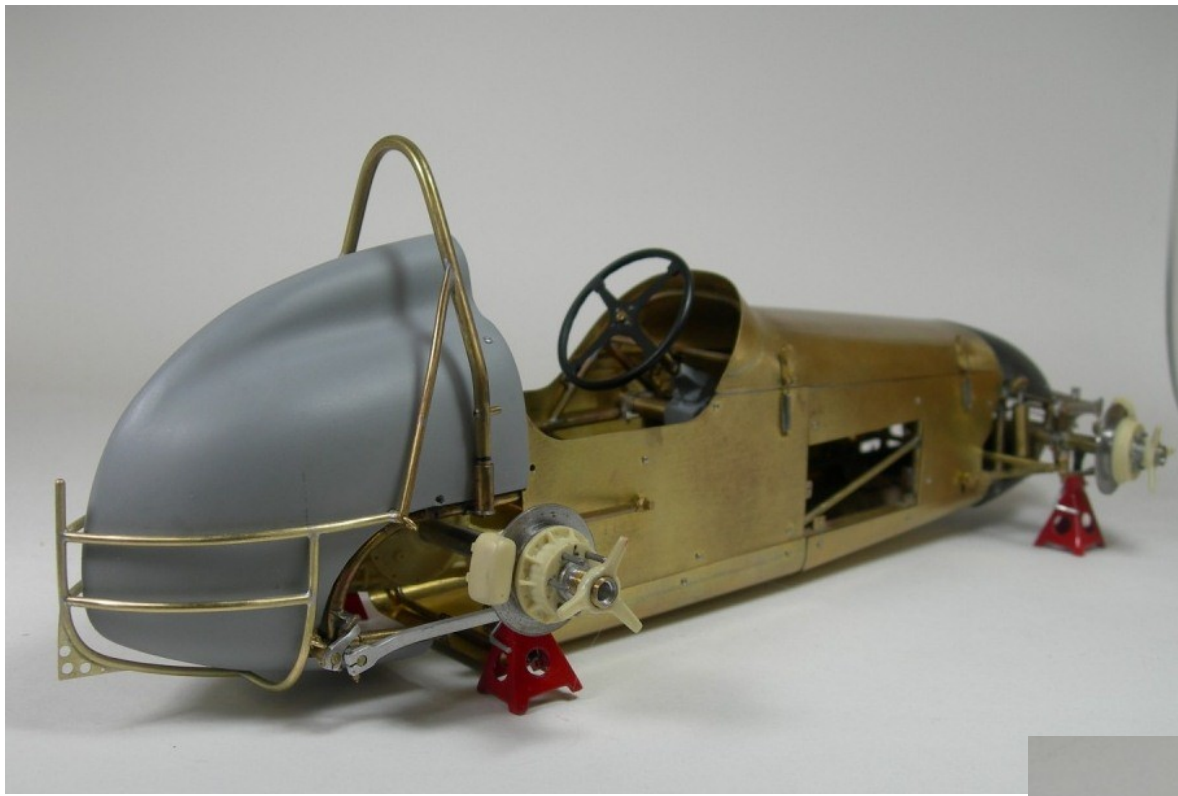
Functional spring-loaded hood latches were also made using photo-etched plates and components from wristwatch band pins. The brass upper latch plates were later replaced with stainless steel parts for additional strength.



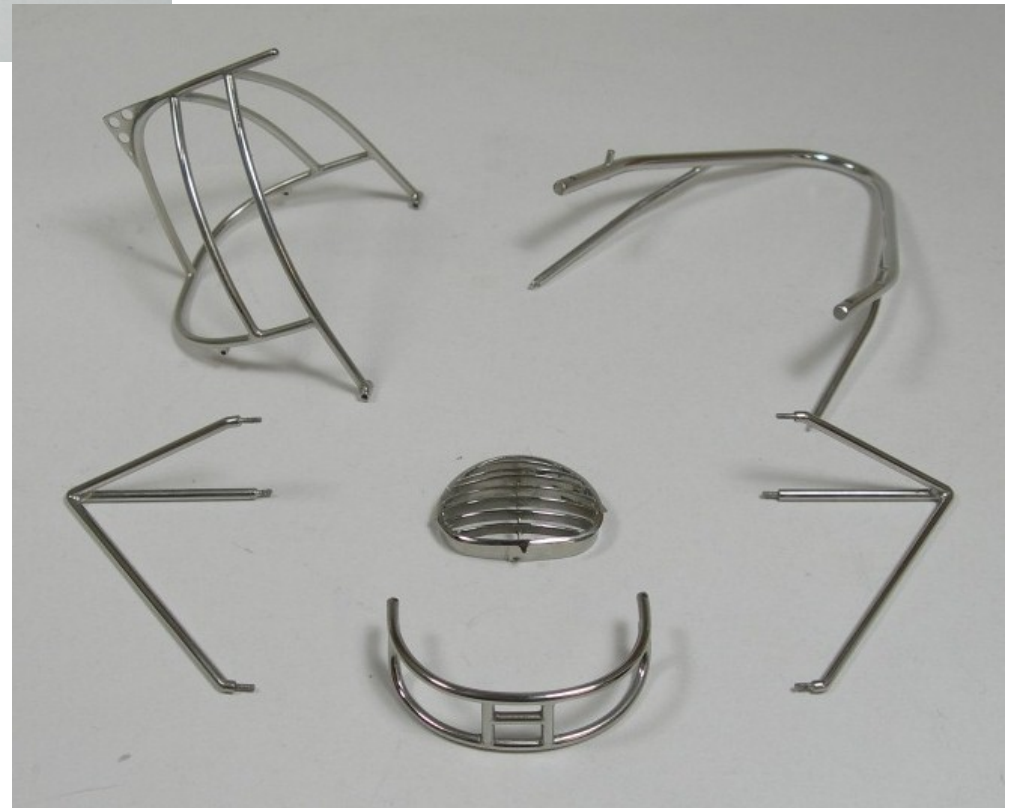


Next it was time to make the roll bar, grill, bumpers and nerf bars. The grill was made by forming a brass strip into the perimeter shape of the grill opening and joining it with the photo-etched surround piece. The vertical and horizontal bars were shaped from 0.015" brass strips and placed into a wooden fixture to ensure perfect alignment while soldering the surround piece to the bars using the butane torch.





The roll bar was formed from 0.125" brass rod, with braces made from 0.062" brass rod, resistance soldered together. The front and rear bumpers and nerf bars were formed from 0.062" brass rod, also soldered together using the resistance soldering rig. These parts were polished until they looked like fine gold jewelry and then cobalt-nickel plated using a Caswell Plating Electroless Plating kit. The results were stunning! This plating process was another one of those surprisingly easy aspects of the build that turned out better than expected.





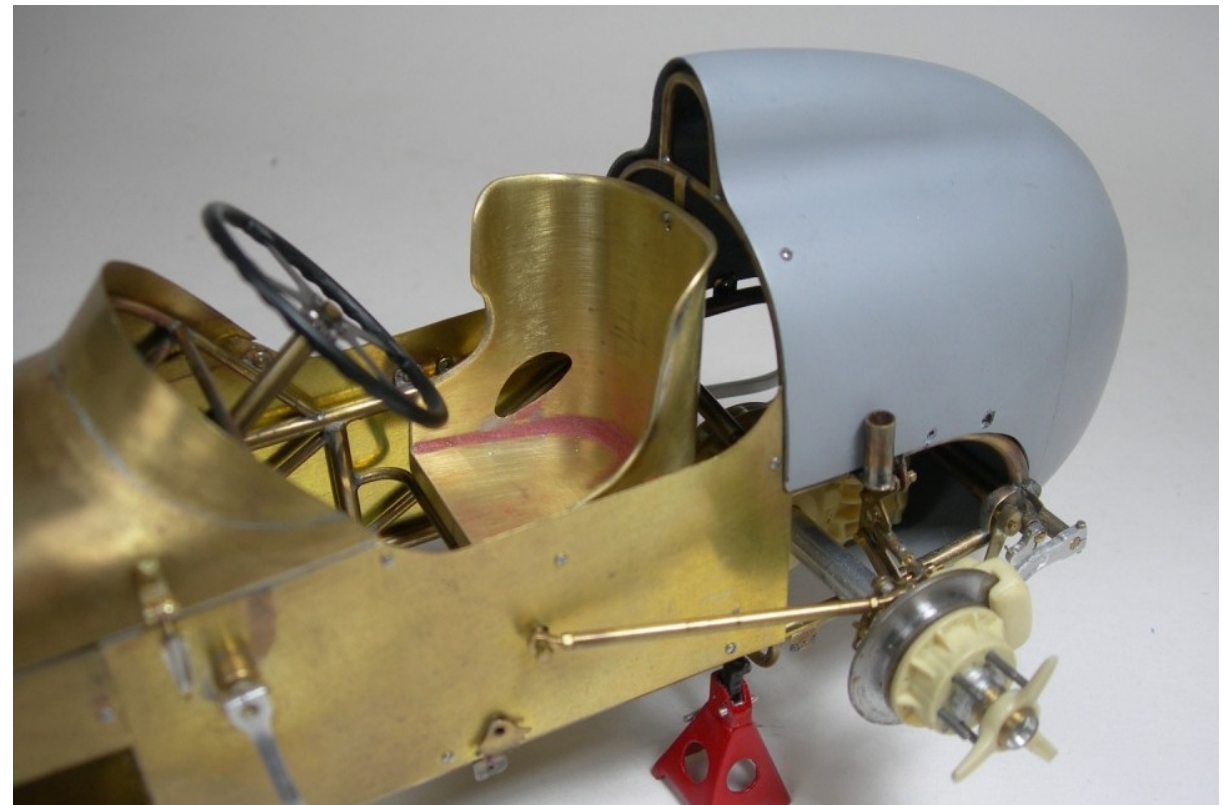
With the exterior pieces now completed, I turned my attention to finishing up all the details under the bodywork. I started at the rear of the vehicle and worked my way forward (had to start somewhere). The fuel tank was duplicated by carving the basic shape out of basswood and adding thin sheet plastic and sheet brass to represent the gussets and attachment plates. The weld detail was added to these plates using small dots of white glue, overlapping them to mimic the weld beads. The big advantage of using white glue for this is if you don't like the results, you can wipe it off with a wet swab and start over again. The gas cap for the tank was machined from brass and painted to look like zinc plating.



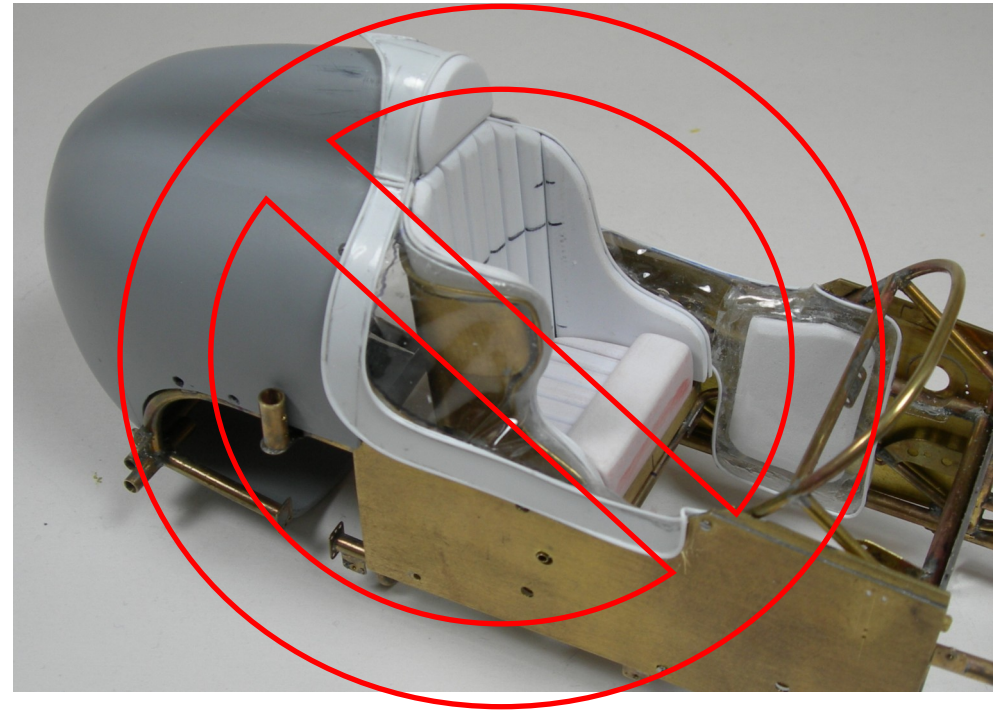
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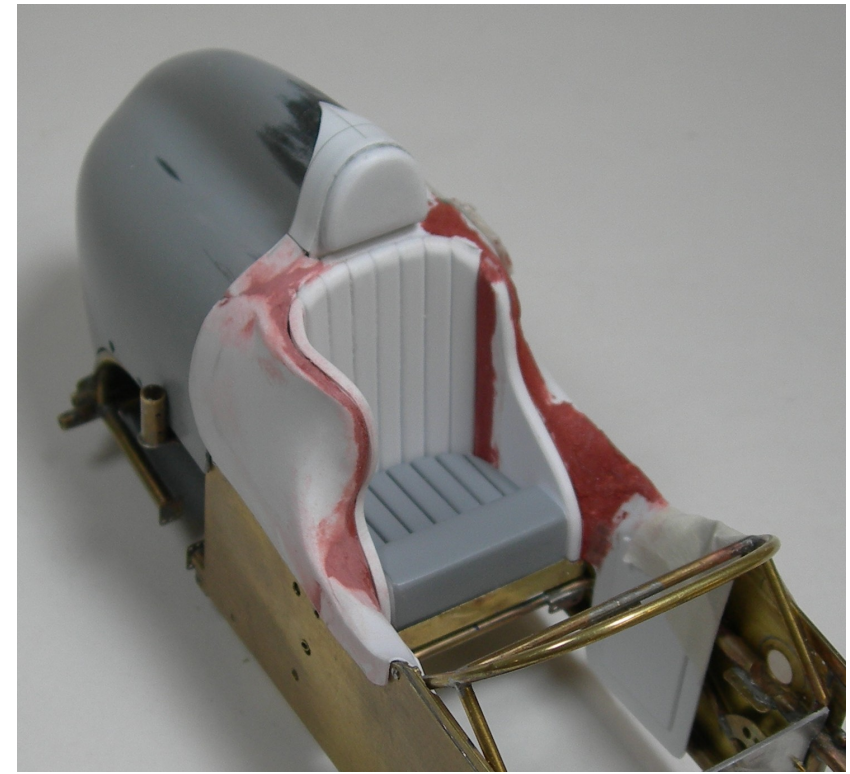
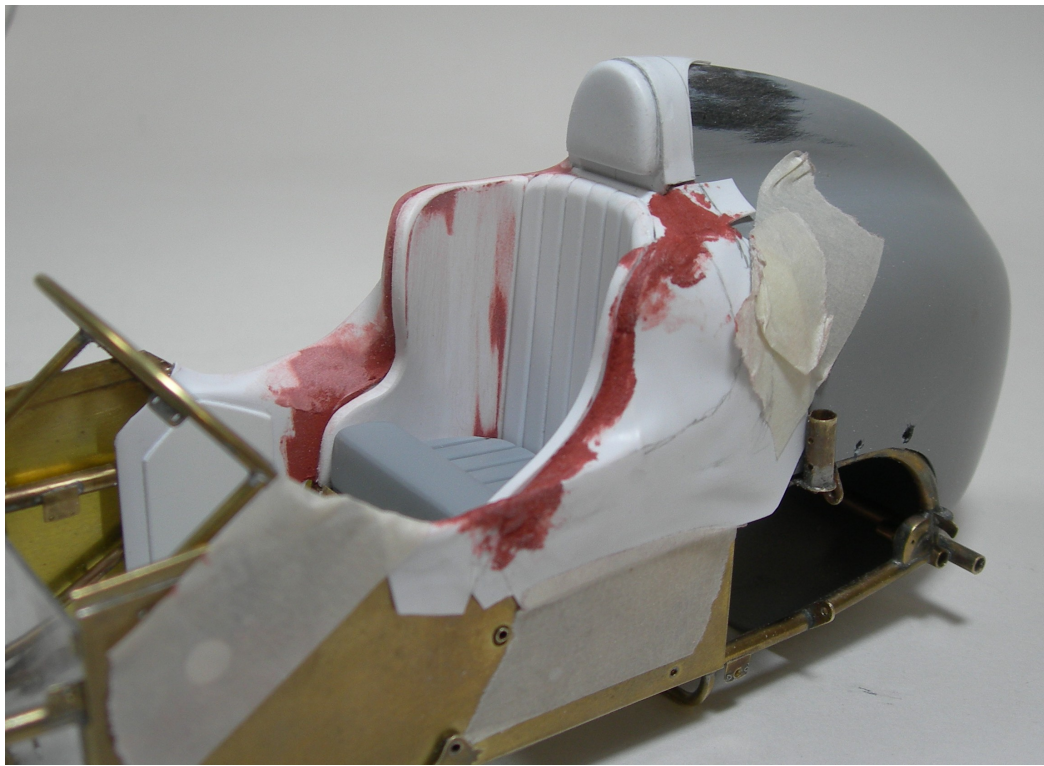


The oil tank was formed from a solid piece of styrene plastic and detailed with plastic tubing fittings and sheet plastic brackets. The seat was next, and it was soldered from 0.010" brass sheet with a 0.020" diameter rod added to the outside edge. Both of these parts were painted with Metalizer paints to represent the aluminum parts in the full sized vehicle.

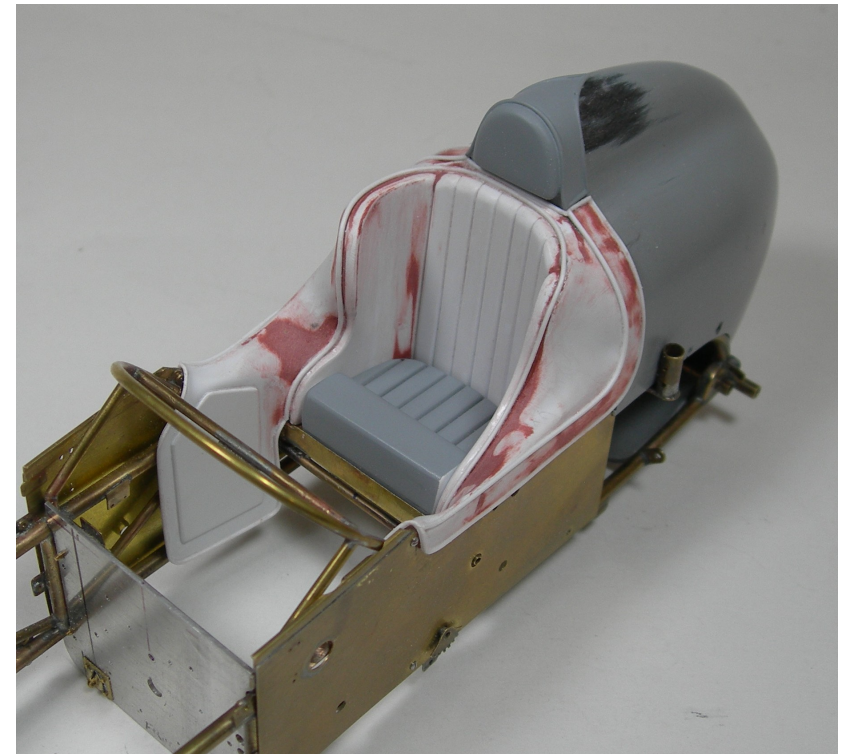


Of course things had been going along so well, there just had to be a problem lurking out there somewhere, and that "bump in the road" was duplicating the seat upholstery. This piece was almost the death of the project. On the full-size vehicle, this upholstery consisted of a pleated seat cover over the aluminum seat and a seat cushion that fit into the bottom of the seat. On the full-sized car these were stitched from vinyl upholstery fabric with foam padding underneath, and then a vinyl surround was attached to the seat cover to bridge the gap between the seat and the bodywork. This surround was attached to the bodywork with a series of chrome snaps. The entire seat cover is a very distinctive part of the car and it needed to be carefully and correctly replicated to give the right look. Replicating the seat cushion was relatively straightforward using styrene plastic strips and shapes, with some contouring to the outside edges to represent the foam padding. The pleated section of the seat back cover was duplicated using styrene strips contoured to give the soft edge appearance of pleated upholstery. The surround turned out to be much more problematic. I needed this entire seat cover to be removable from the car and it needed to look like stretched vinyl. I also needed to be able to paint it in some manner to give it the correct red color. After numerous attempts using several types of clear vinyl, solid vinyl sheet, and even thin copper sheet, I was totally frustrated as none of them gave the desired appearance or had the strength to be removed and reinstalled.





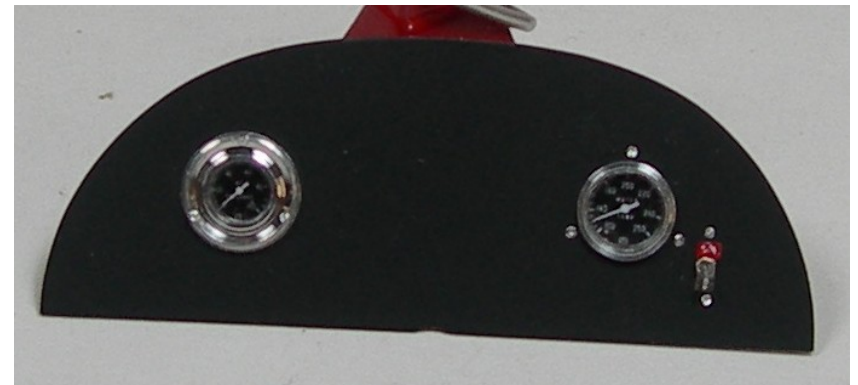
I have never been so close to giving up on any aspect of any model project as this one. Then I finally tried heat forming 0.010" styrene plastic. I was able to attach a piece of sheet styrene to the inside of the seat form, and while applying heat from a heat gun, stretch the plastic out and over the body work. This method achieved the desired "look" of upholstery, and even better, I could easily attach 0.020" diameter styrene rod to the perimeter to represent the piping. It was also easy to primer the piece, and then paint it using red shoe dye to give the desired color and tone. The chrome snaps were replicated using the heads of sewing straight pins. The seat cover was finally complete, but this one "simple" part of the model consumed over 6 months of time as a variety of materials and methods were tried prior to the final solution. I know the lesson there is "never give up," but that is really tough to remember when you are in that deep with no apparent solution at hand.

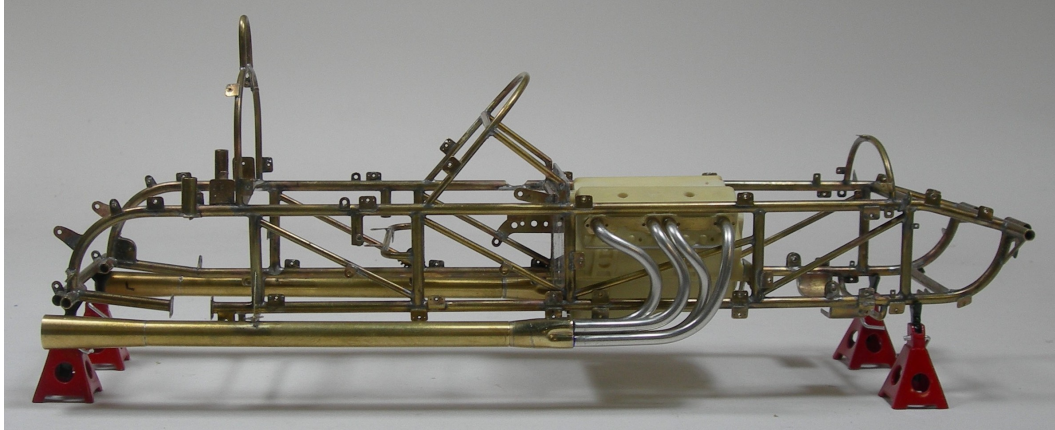




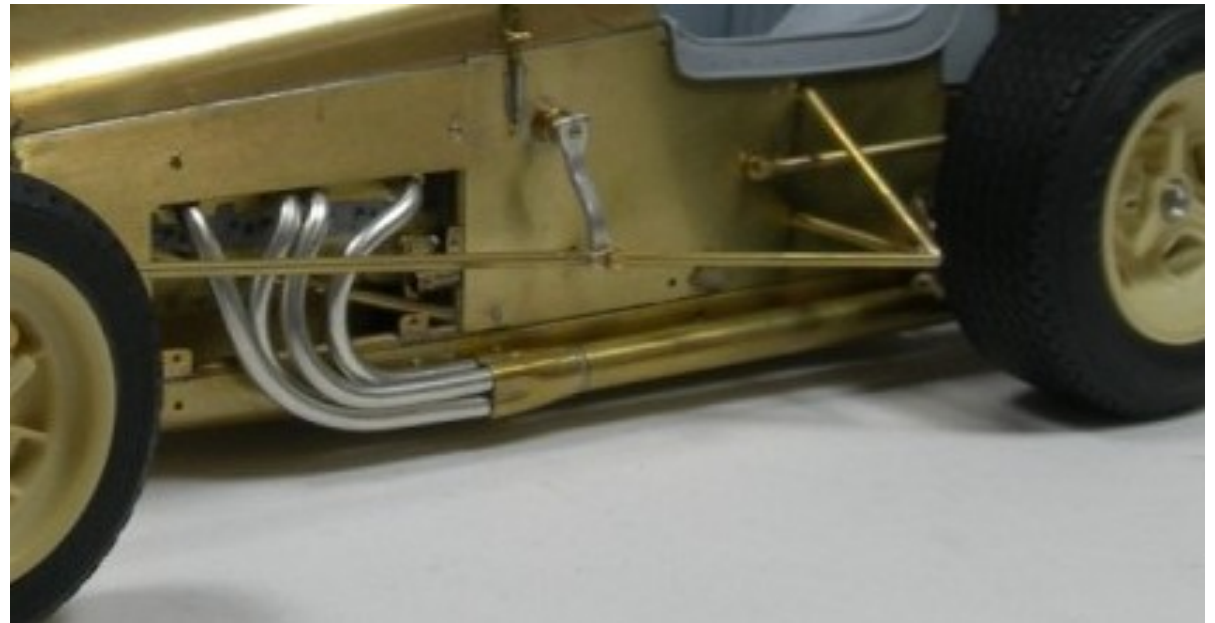
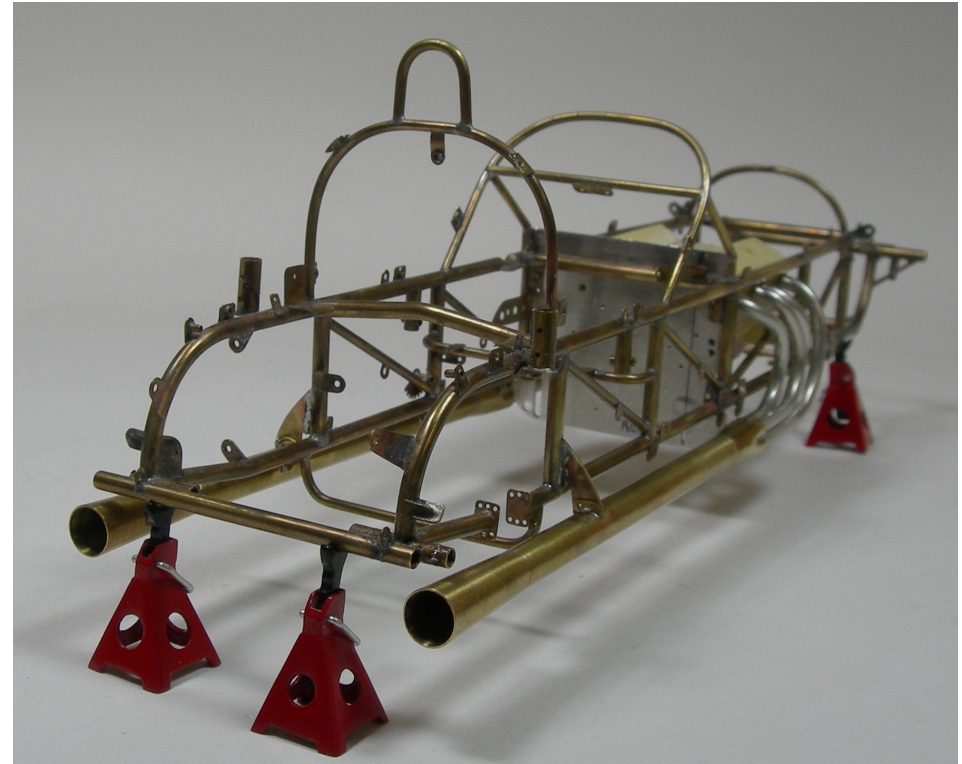
Safety harnesses were next, and they were replicated using photo-etched brass hardware with brass rod details soldered to them. The belts themselves were made from self-adhesive nylon from a fabric store. A small piece of book binding leather was added to the lap belt buckle and the manufacturer's labels were made by photo-reducing pictures of the full-size harness labels.

The interior was finished off with an instrument panel made from 0.010" thick aluminum sheet used as roof flashing and available from most home improvement stores. Gauge bezels were machined from aluminum and polished to look like chrome, while gauge bodies were machined from brass rod. Gauge faces were photo reductions of pictures taken from a gauge catalog. The "glass" faces were cut from clear styrene sheet with a Micro-Mark Micro Punch set. I prefer to use clear styrene instead of acetate for gauge glass as it has a more clear appearance and resembles glass better.





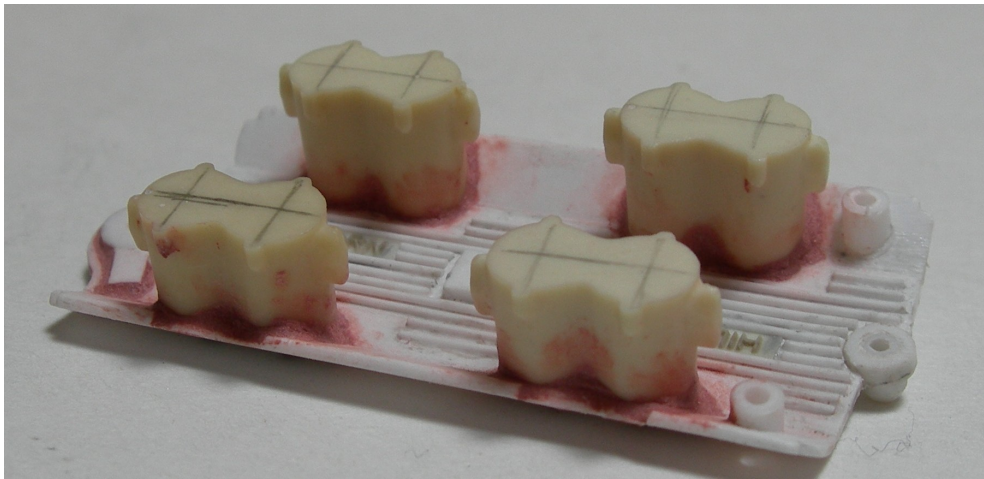
Building the headers and exhaust pipes was next on the agenda. Headers were formed from 0.125" solid wire solder, joined with photo-etched flanges and collectors made from brass tubing. Exhaust pipes were made from brass tubing, including the megaphone ends which were constructed by removing a wedge section from brass tubing and reforming the remaining tube into a conical shape and rejoining the edges with silver solder. These pipes and headers were painted with Alclad Chrome over Tamiya Gloss Black. The perforated header guards were formed from 0.010" brass sheet, drilled with the vent holes, then cobalt-nickel plated.





I was now well over four years into the project and it had reached that point where it needed to be finished soon or burnout would rear its ugly head. Still remaining to be built were all of the engine compartment components and details, followed by paint, markings and final assembly. While there was a great amount completed, there was still a long way to go, so onward to the engine details!

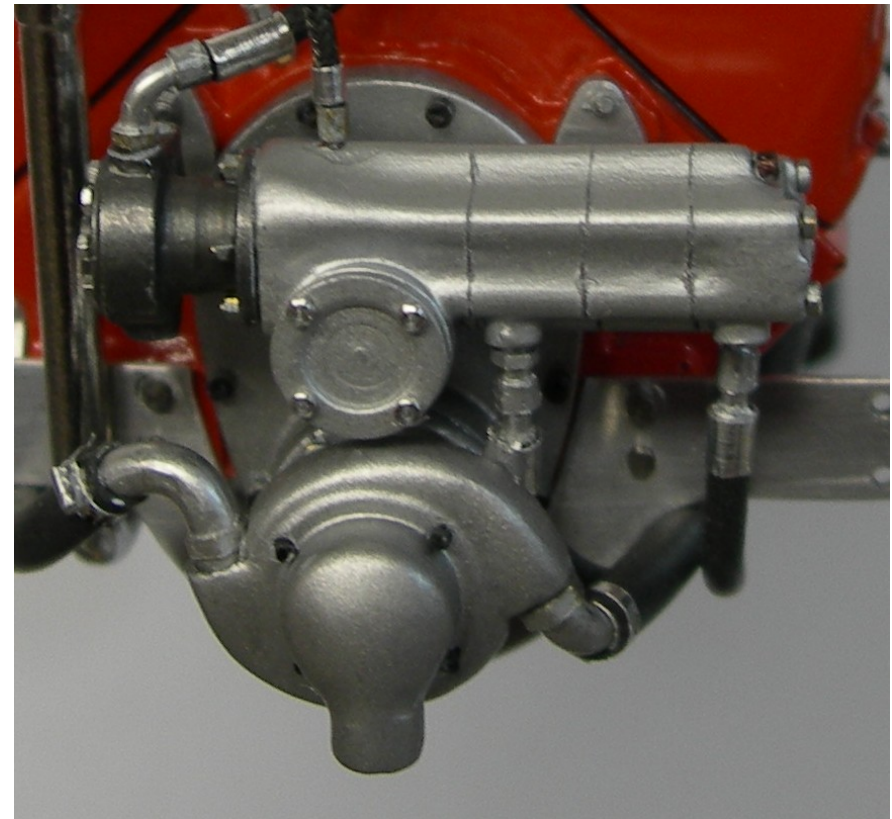
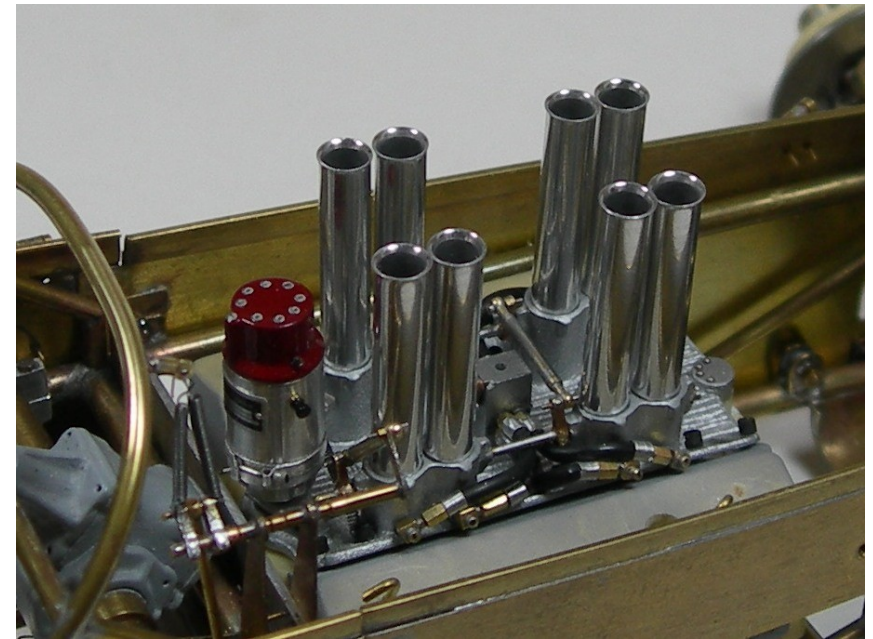


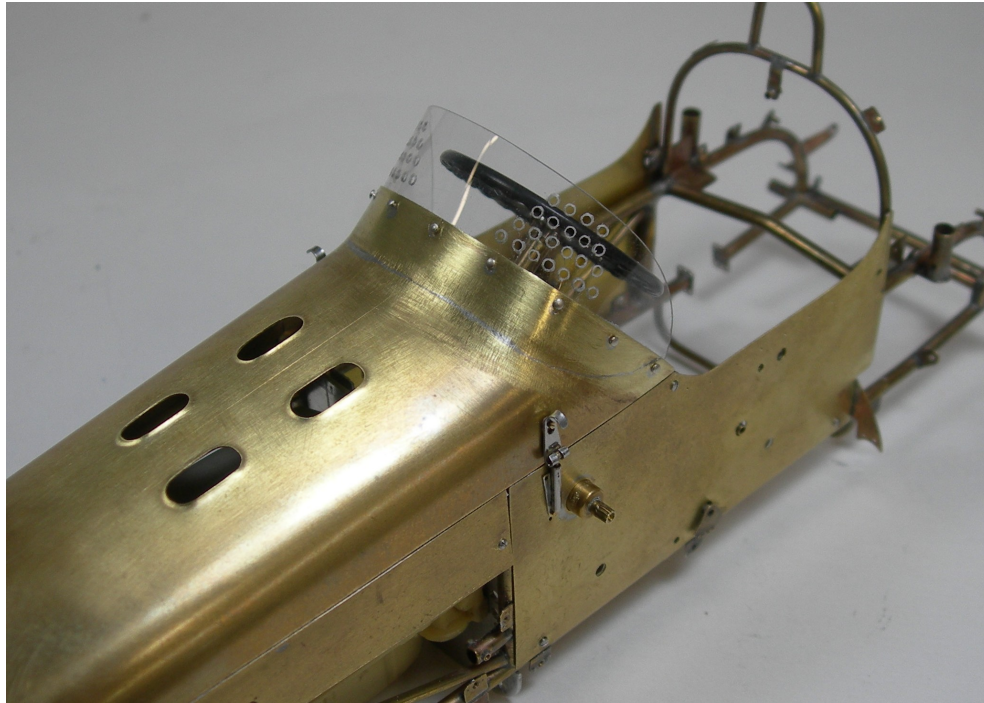


The intake manifold was resin cast from a master built from styrene sheet, resin cast throttle plate bodies, and resin cast lettering. Lengths of plastic tubing were insert molded into the resin manifold to provide the location holes for the throttle plate pivot shafts. This avoided the problem of having to drill a very small, long, straight hole through each bank of throttle bodies for this pivot shaft. The functional throttle linkage was fabricated from brass rod, photo-etched bell-cranks, photo-etched plates, and 0.5mm stainless steel fasteners. Throttle return springs were hand wound from 0.006" music wire using a 0.020" drill bit for a mandrel. Fuel lines were duplicated using wire insulation and hand-fabricated brass fittings. Injector stacks were made from 5/32" aluminum tubing, flared using a rounded wooden tool, then polished to look like chrome plate. The magneto was scratch-built from aluminum and brass, then detailed with thin sheet aluminum and custom-made decals.

The fuel, water, and oil pumps mounted on the front of the engine were fabricated from styrene, detailed with various fasteners and fittings, then painted with an assortment of Metalizer paints to resemble the aluminum/iron castings of the originals.

The radiator was made from sheet styrene with a resin cast core section. It was finished with Alclad Polished Brass paint and the solder joints added using Metalizer aluminum paint.



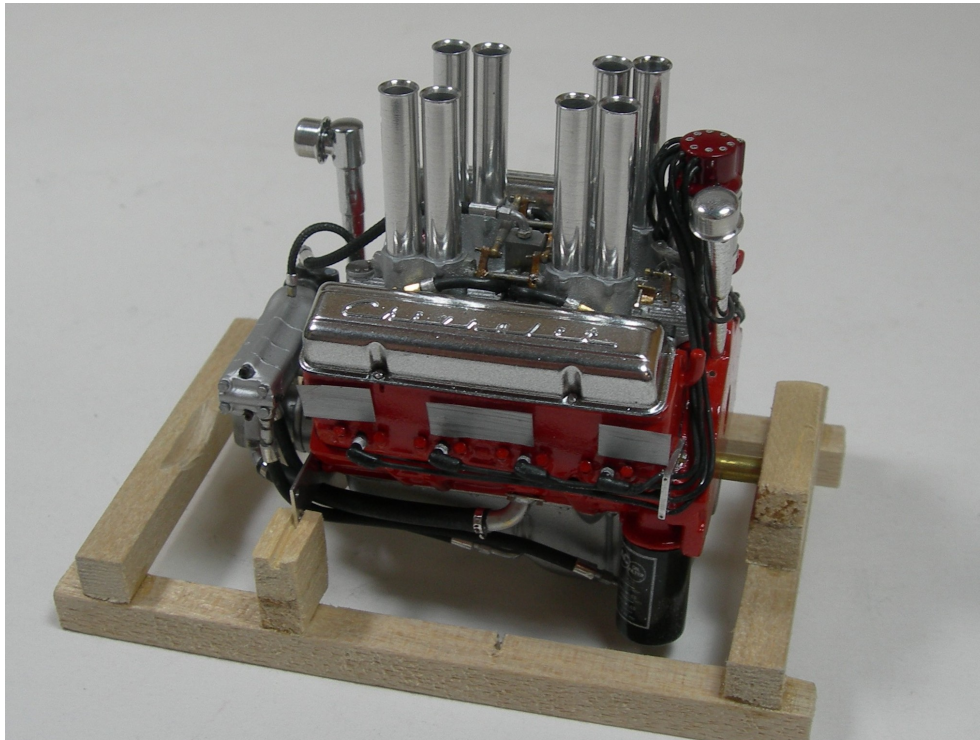


The openings for the injectors were very carefully cut into the hood using a locating fixture made from Plexiglas sheet. This fixture was temporarily attached to the side frame rails and was used as a drill guide to start the openings. They were then slowly enlarged with a file and when the basic size and shape was correct, the flared edges were formed using a custom punch and die set made from an aluminum die with a hardwood punch. The windshield was added at this point, made from 0.010" clear acetate, with individually punched 0.050" vent holes added using the Micro-Mark Micro Punch Set.

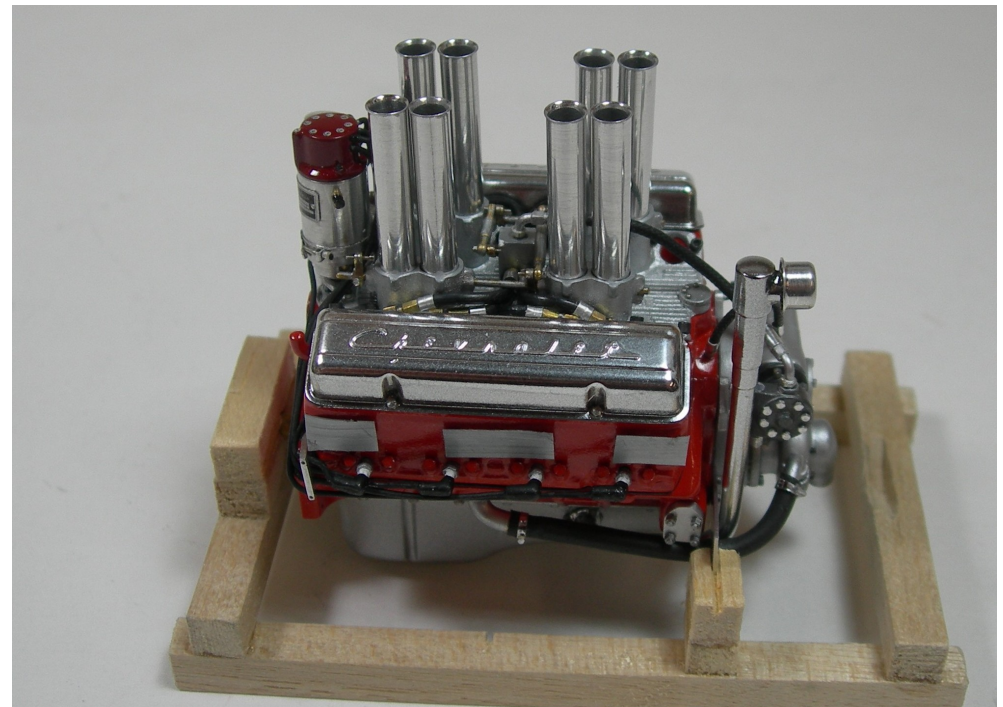


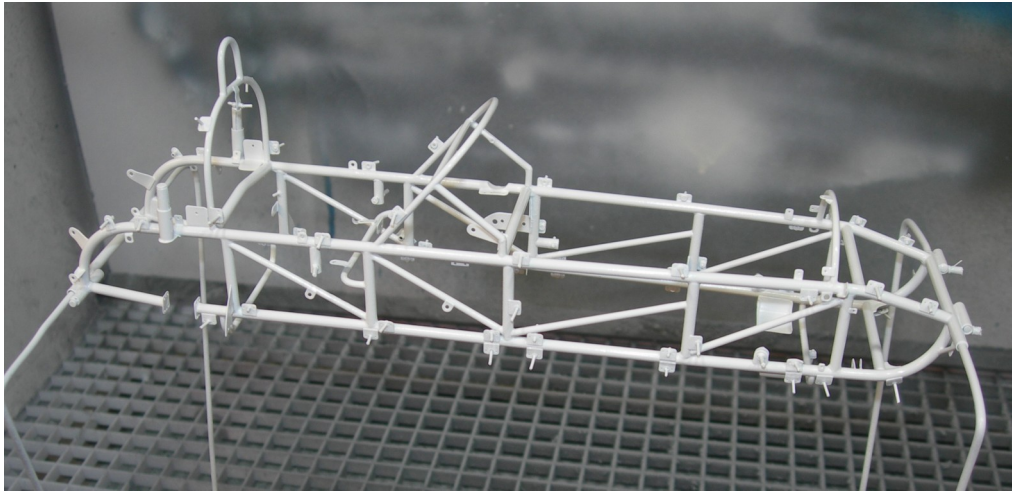
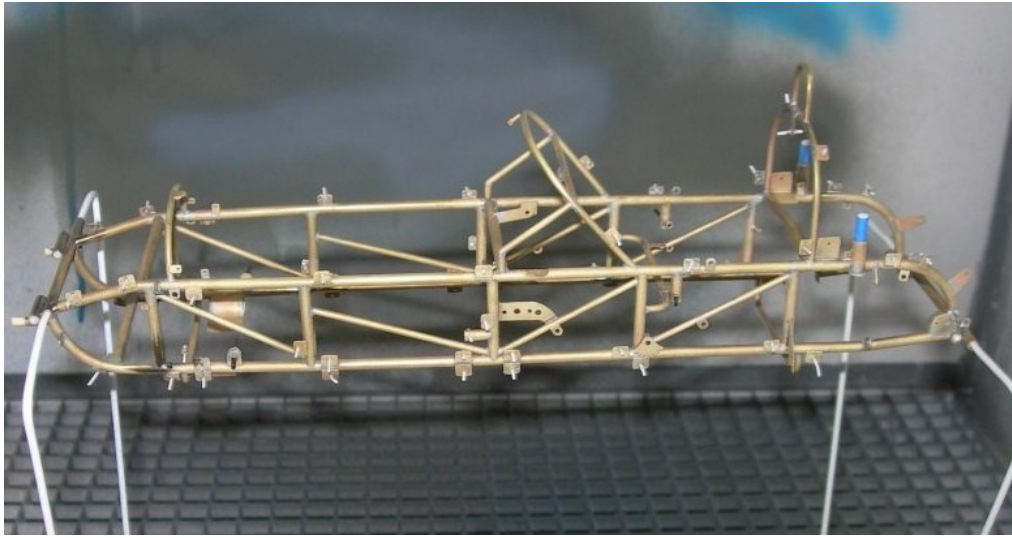


Once all the parts were fabricated, but before final paint and assembly, it was time for a "group photo". I always like to take a few pictures of the collection of parts, as a reminder of the many hours spent and the many challenges overcome to get the project to this stage.

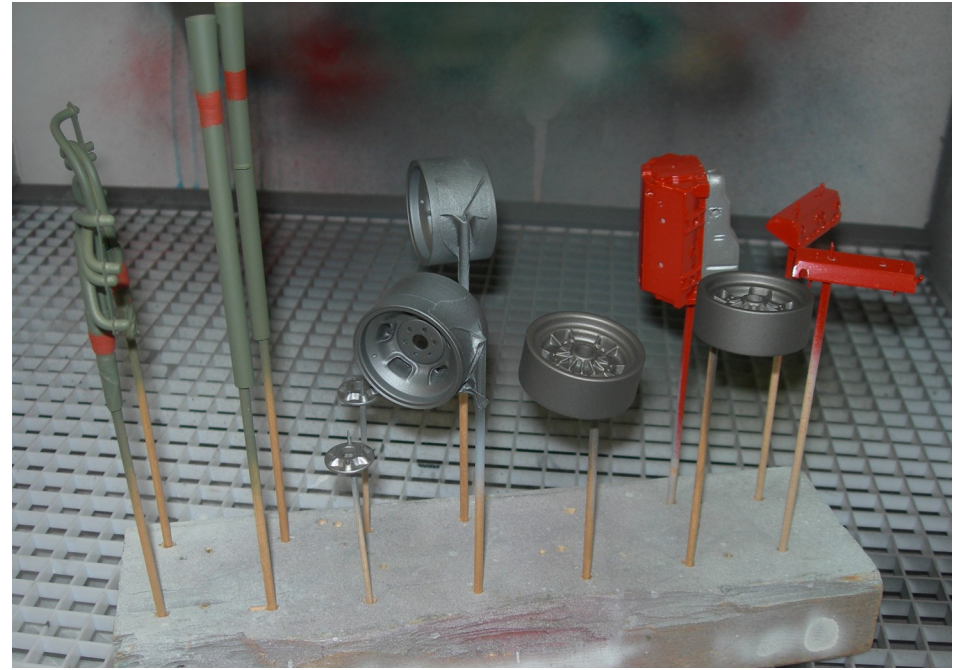


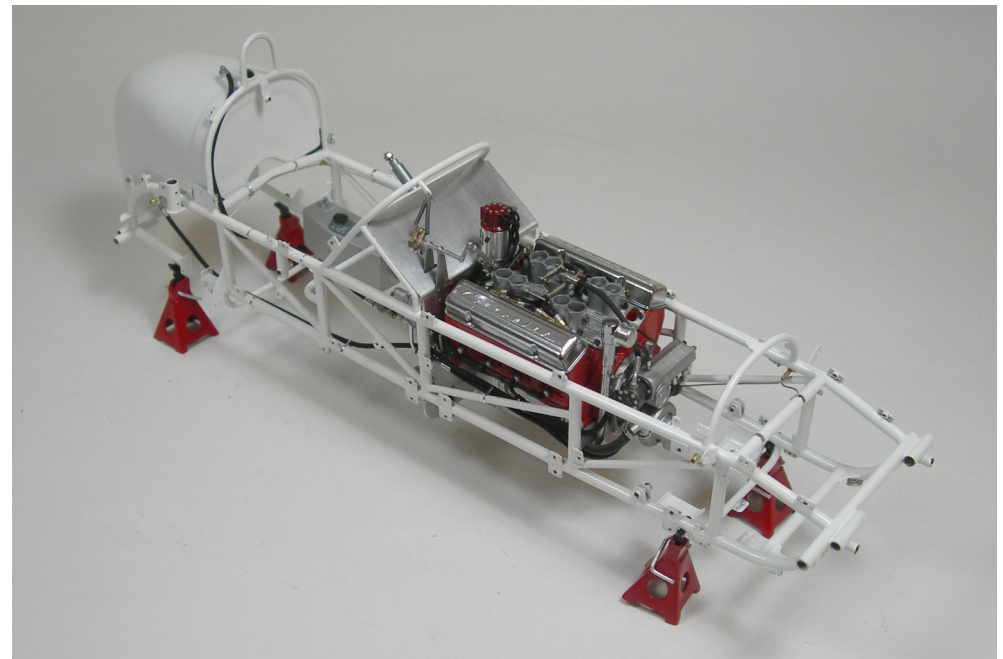
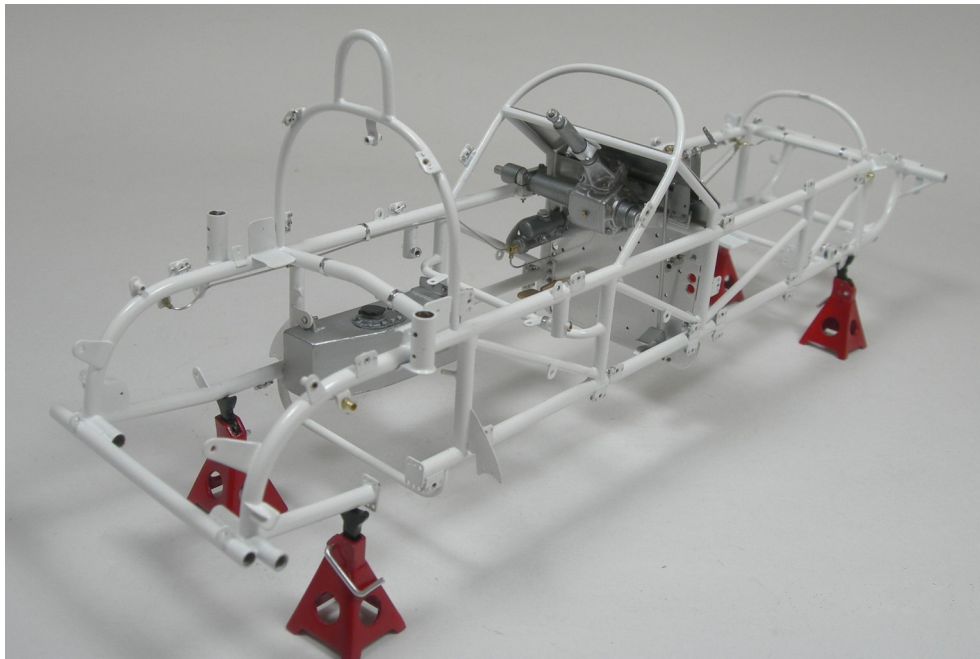
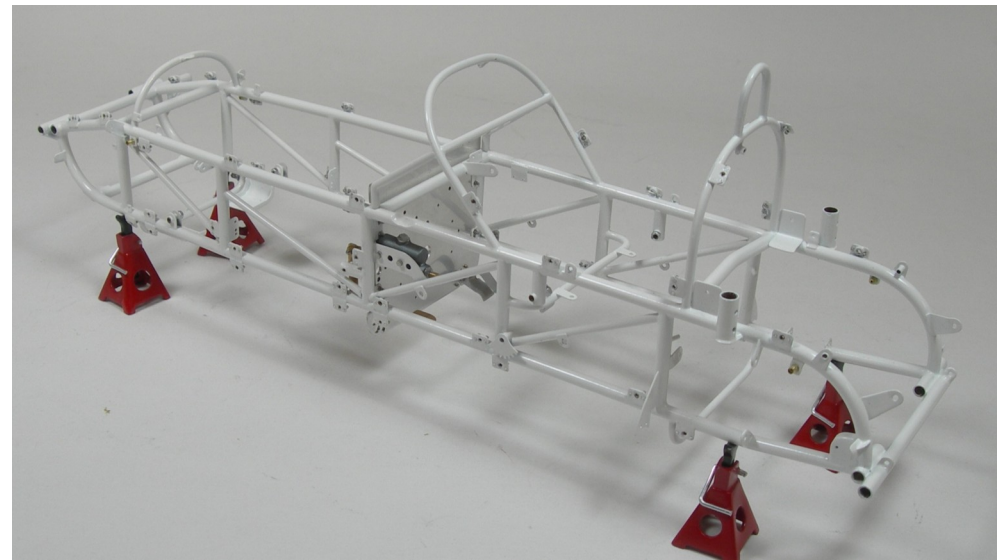
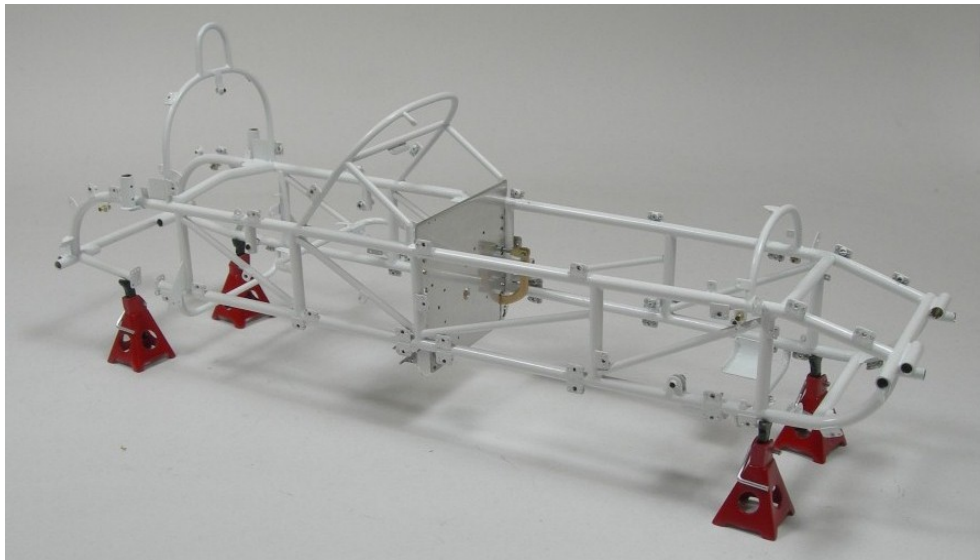
The engine was the first major component assembled. Coolant lines and oil lines were replicated using heat shrink tubing over solid core solder, while the fuel lines were made from Pro Tech braid, painted flat black to resemble the fabric covered hoses used in that era. A spark plug and plug boot master was made from brass and styrene. Multiples were cast from resin, then joined with plug wires made from solder. The oil filter was machined from Plexiglas and detailed with a decal made from artwork found on a Corvette restoration website. Valve covers were resin cast from a master made by modifying one of the valve covers in the Tamiya Lola T70 kit, and they were "chrome plated" using Alclad Chrome paint.



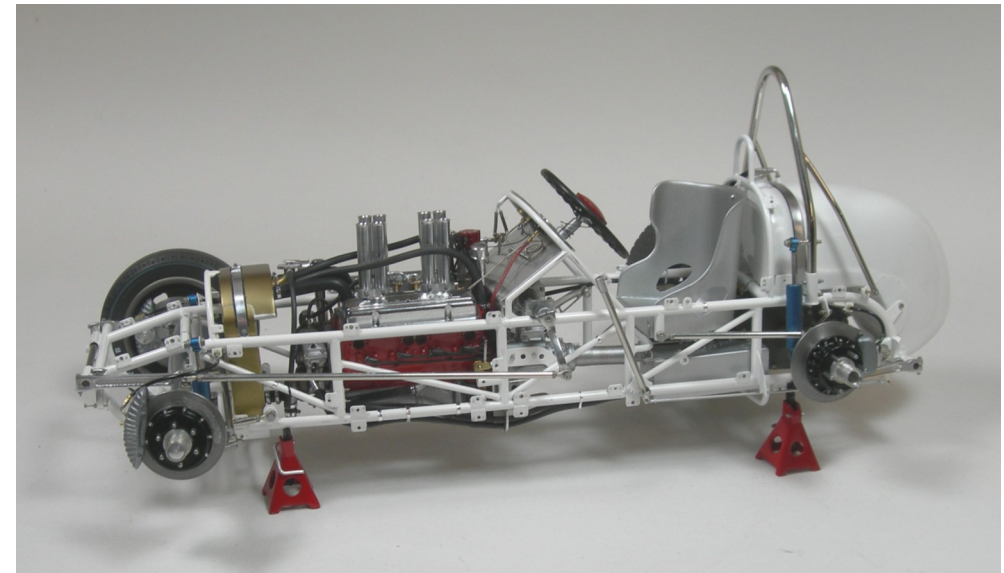
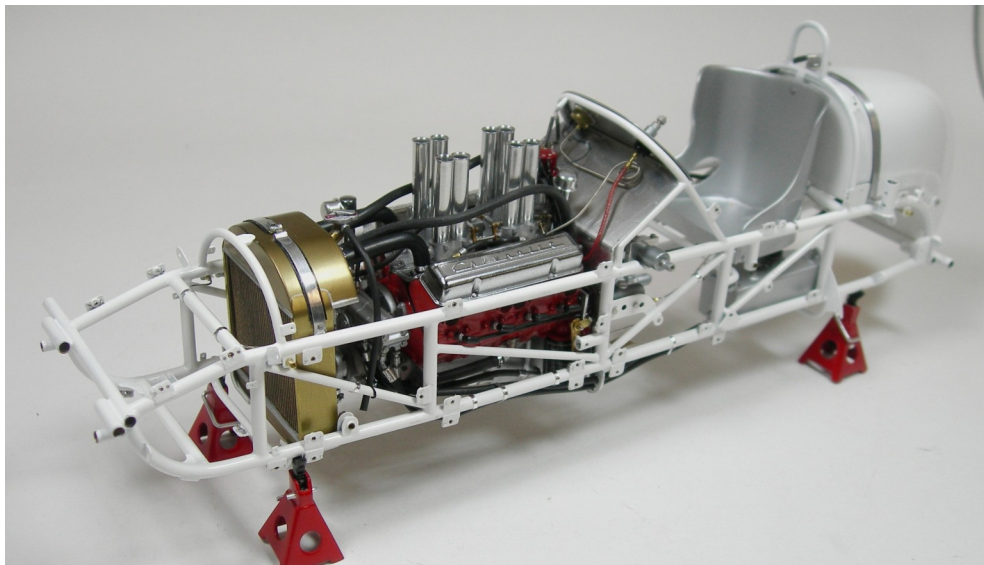
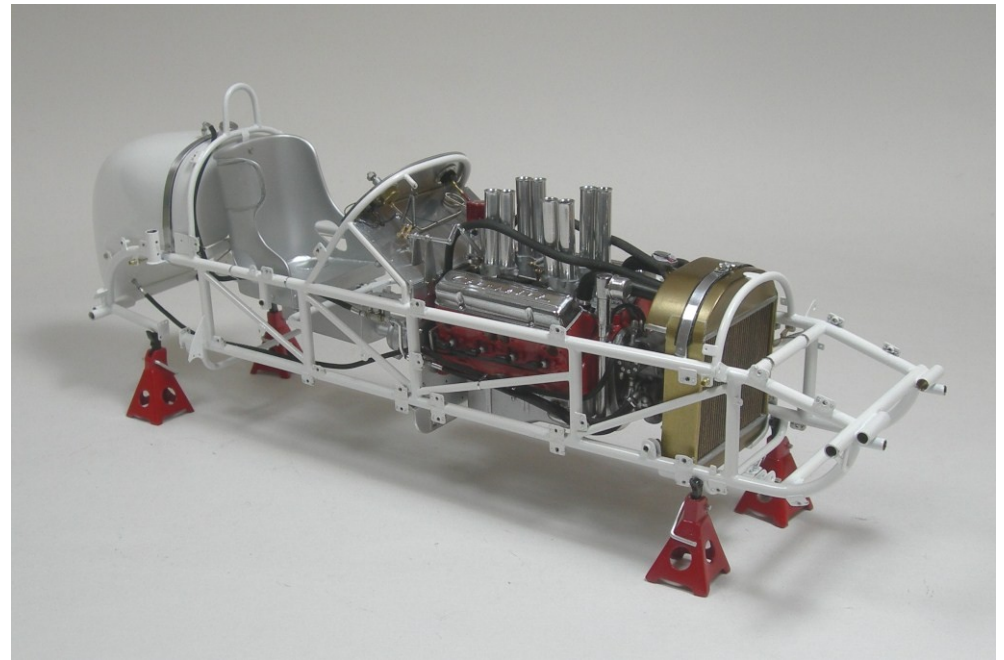
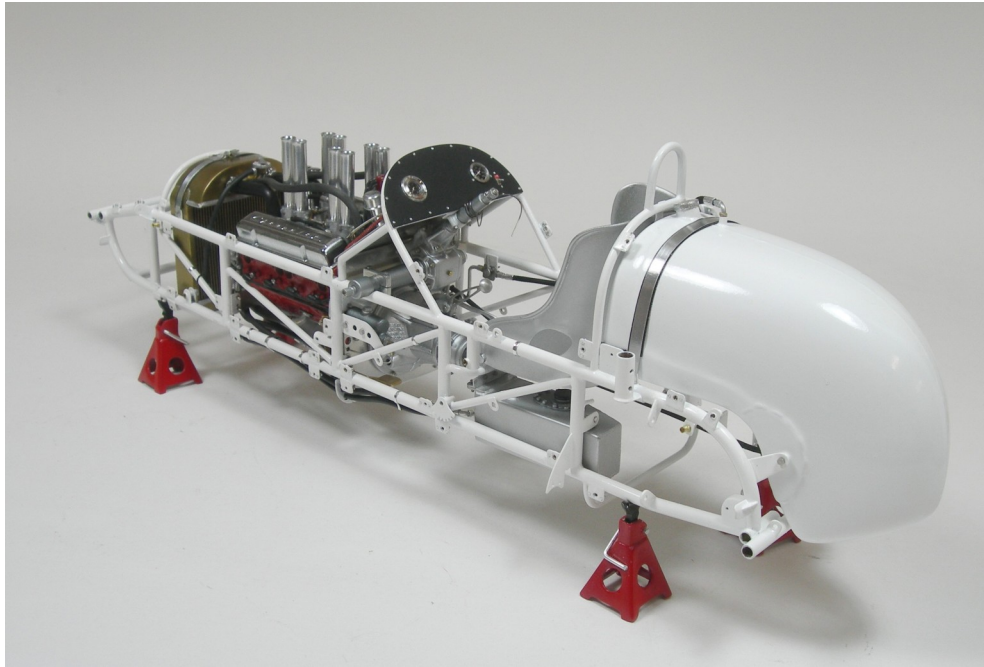


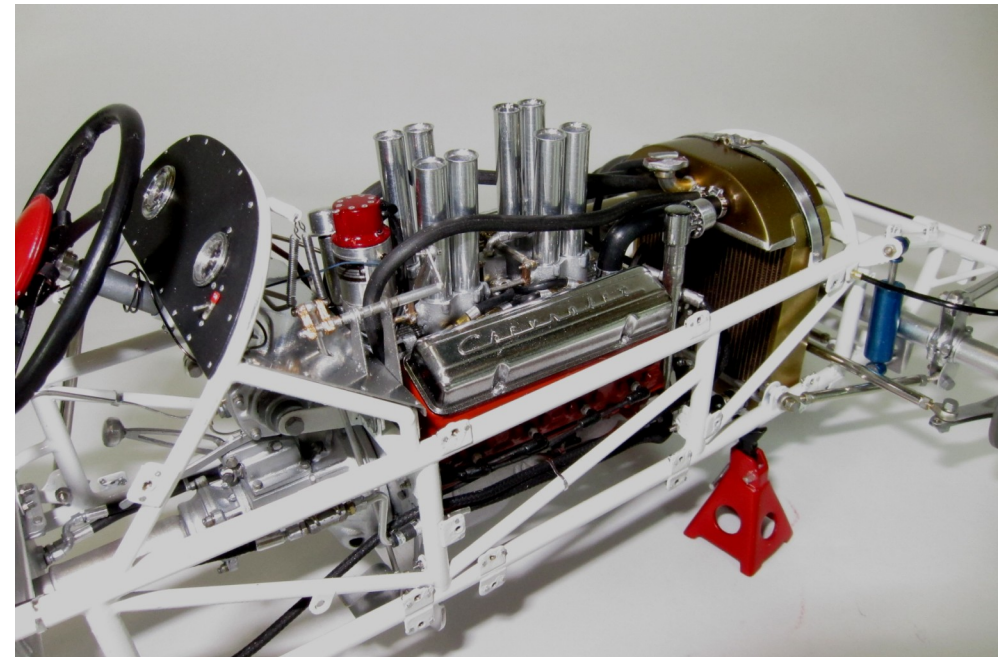
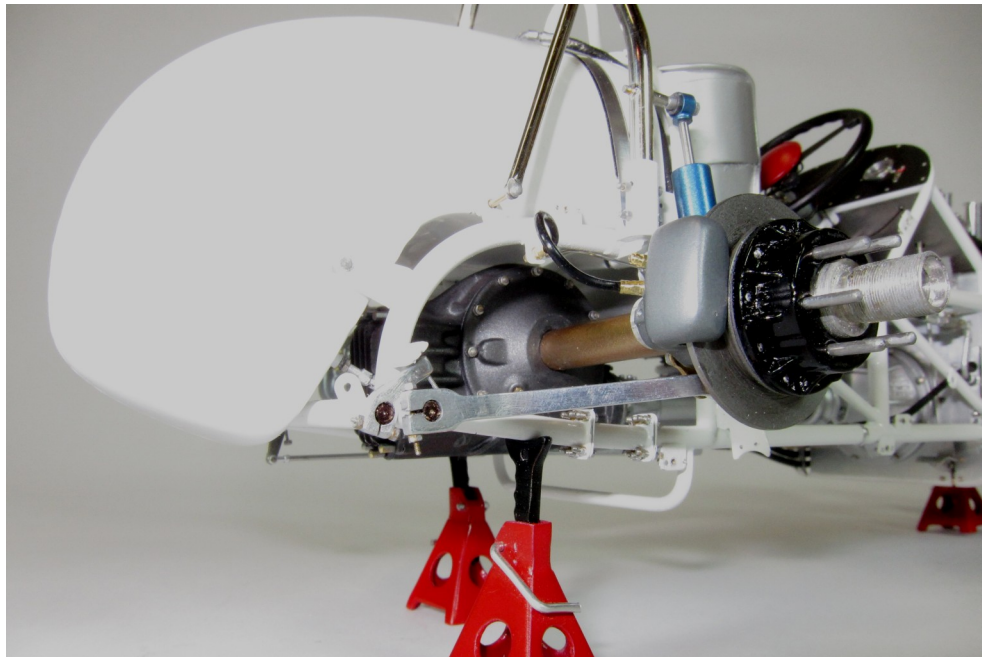
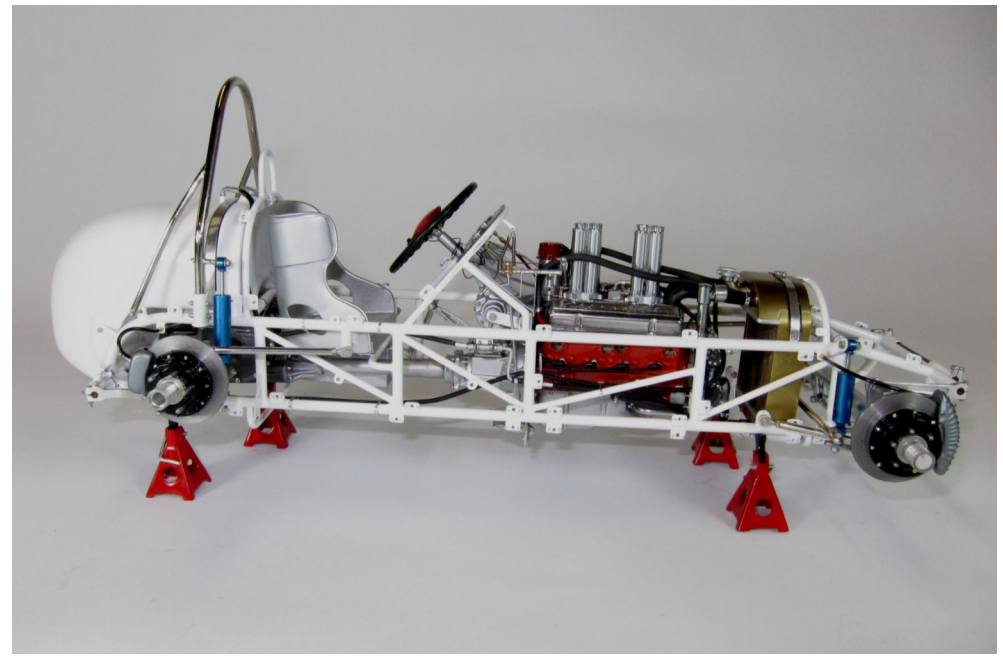
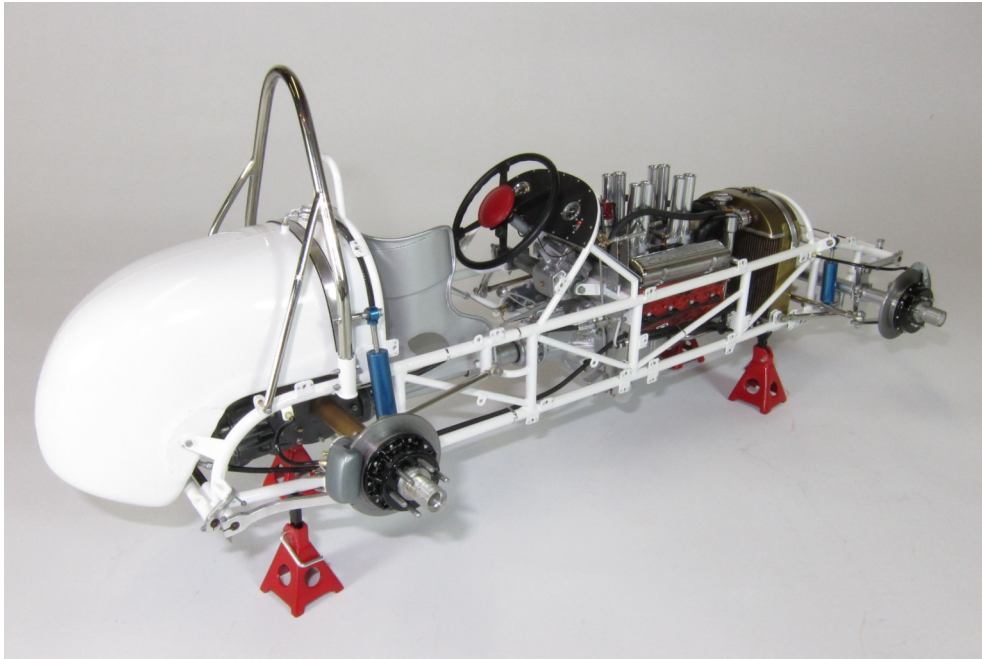
The frame was next to be painted and given its complex nature I decided to bead blast it with a Badger Abrasive Gun, using aluminum oxide particles to clean it prior to paint. It was painted using a metal etching primer followed by gloss white lacquer. All the other chassis and engine parts were painted at this time as well. The seat cover was sprayed with red shoe dye to give it the appearance of naugahyde vinyl.

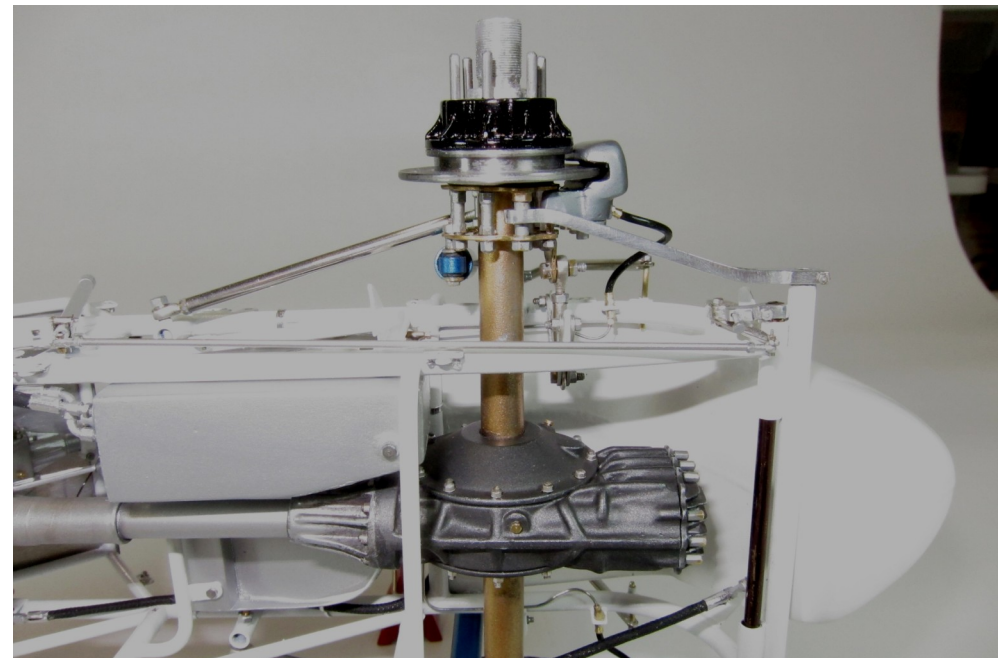
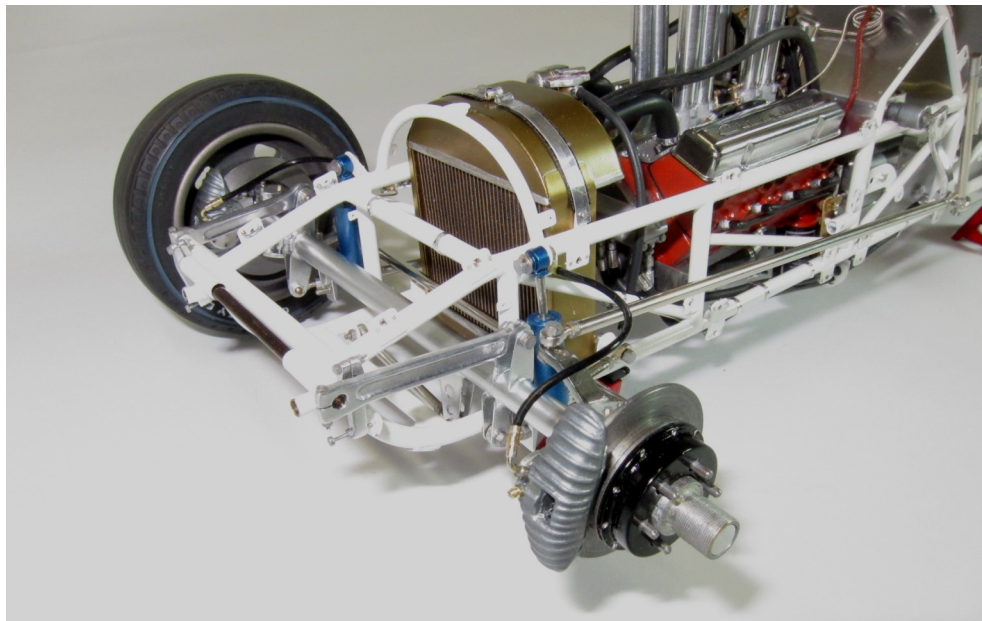
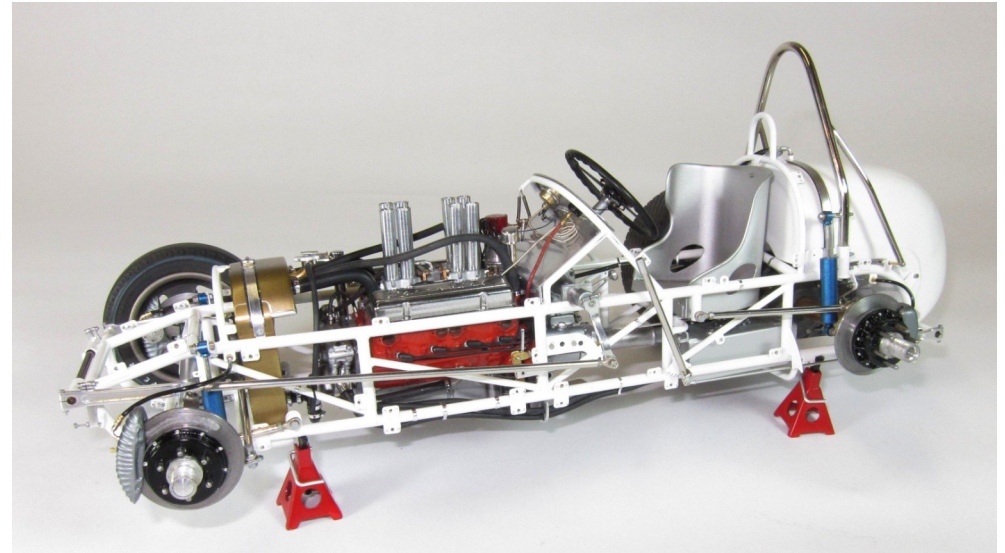
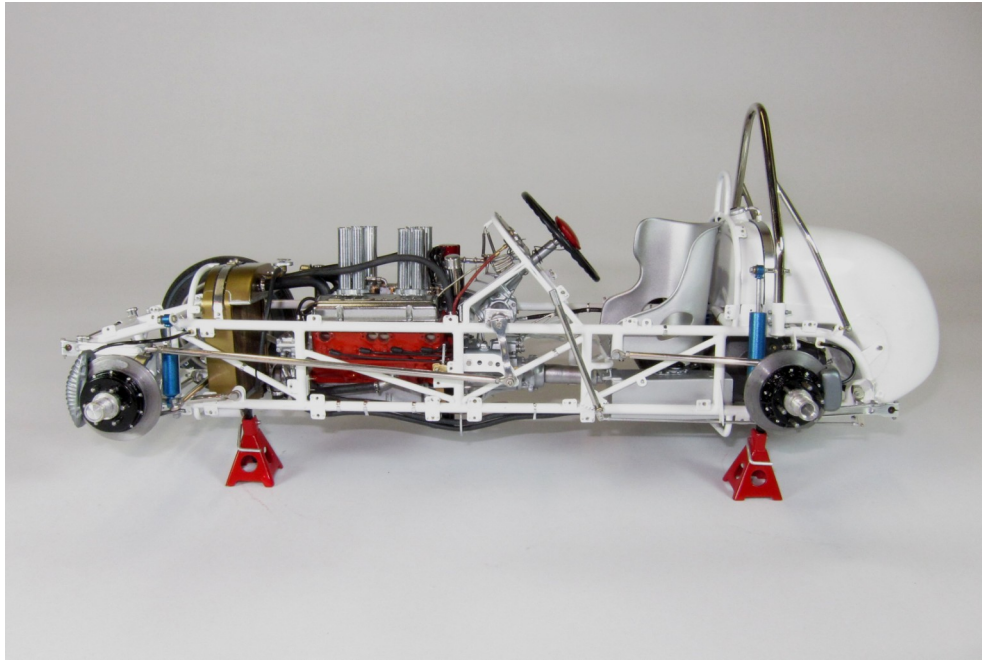


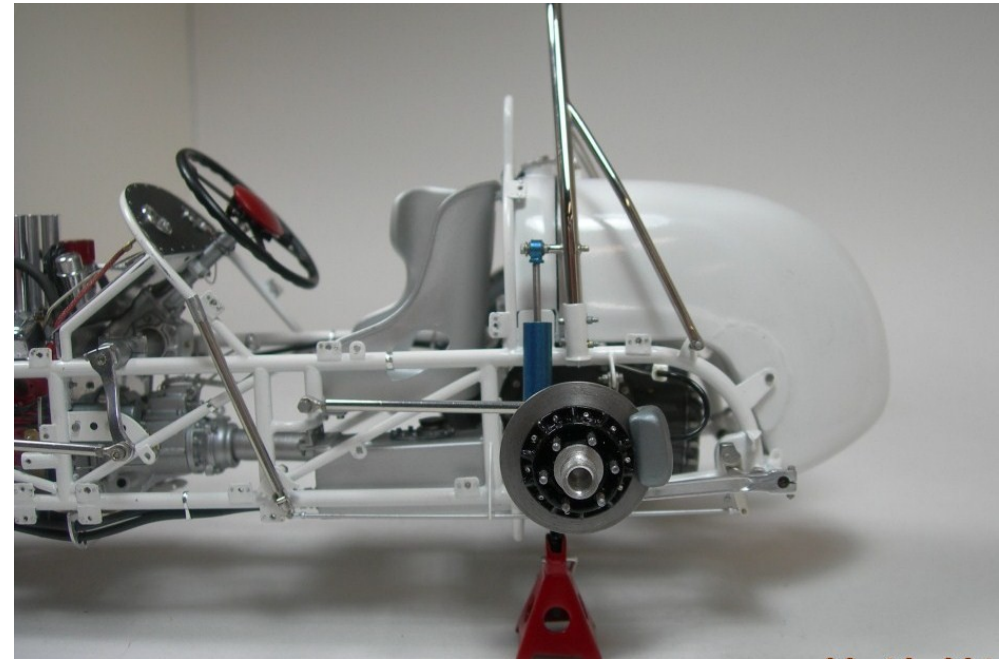
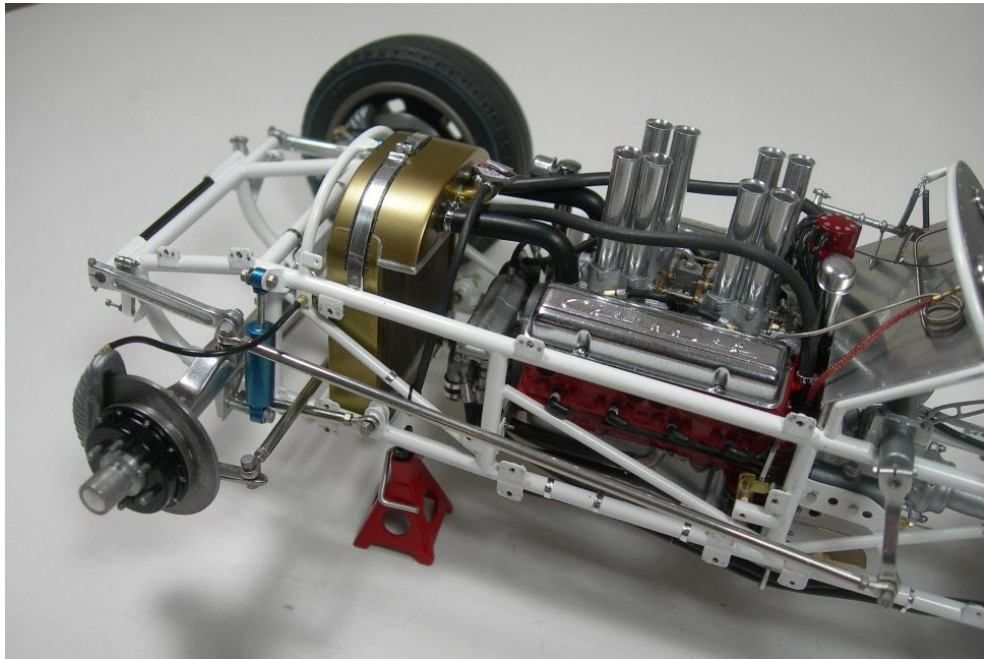
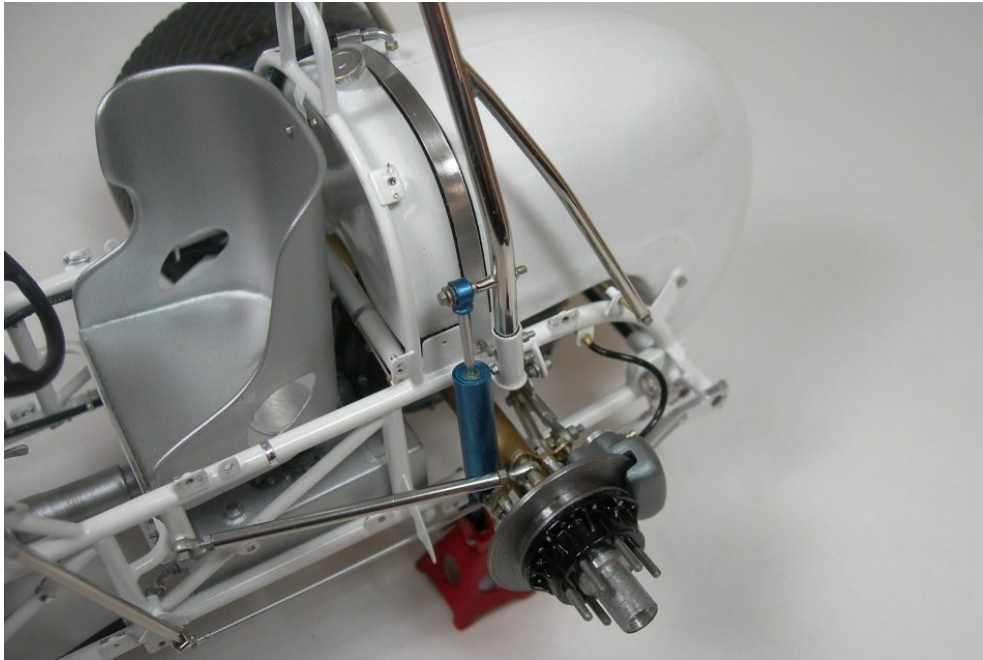


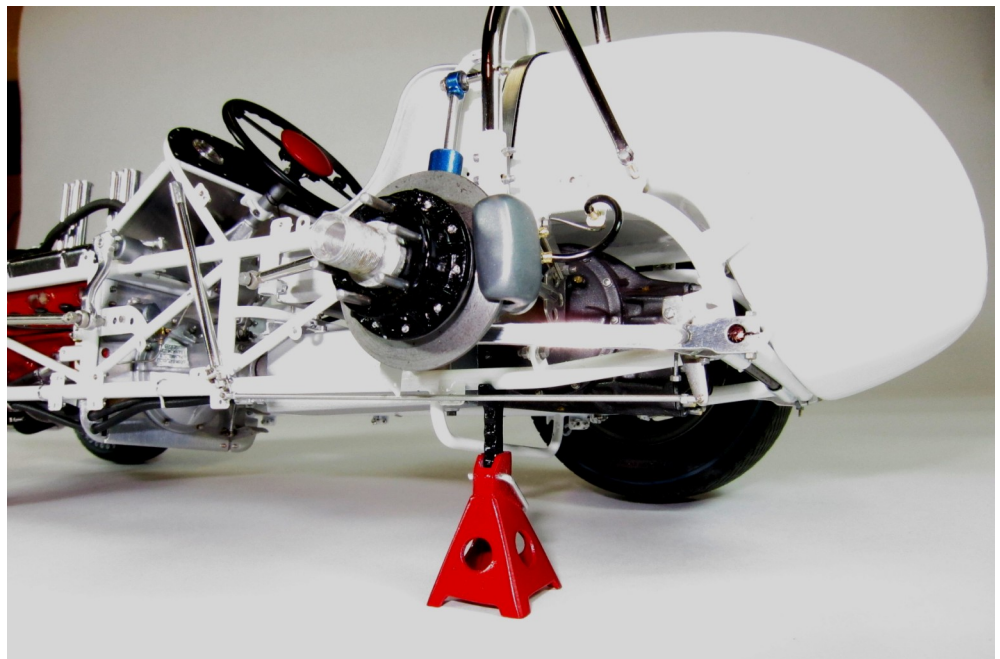
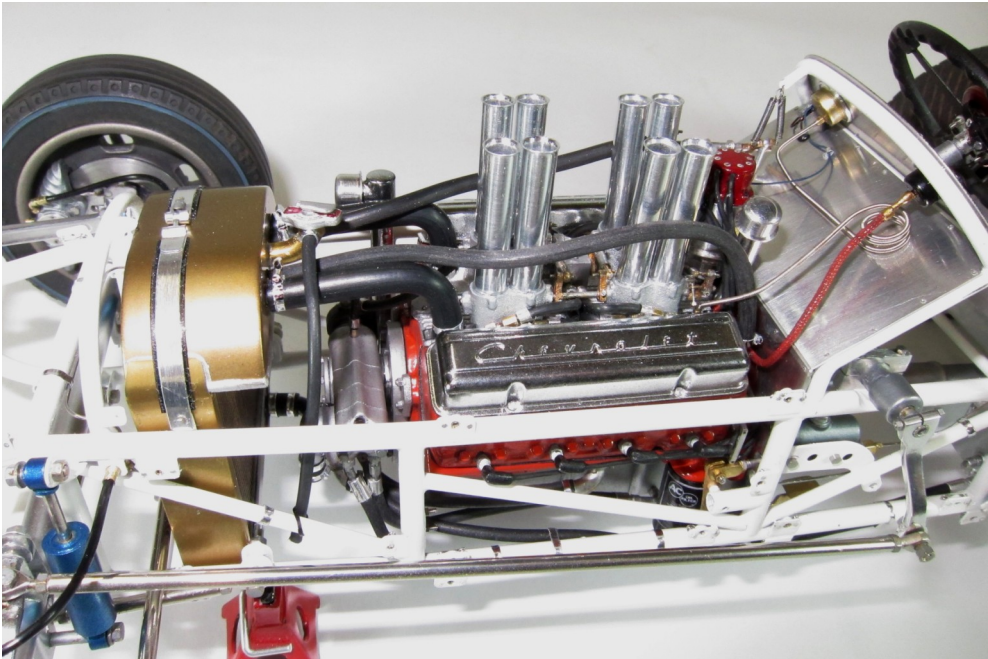
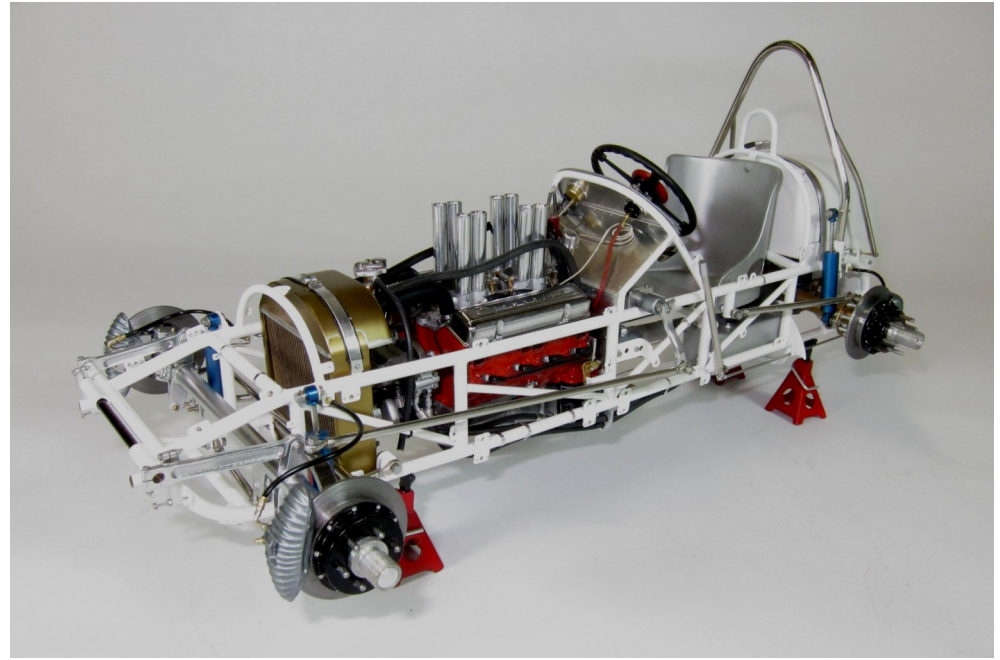
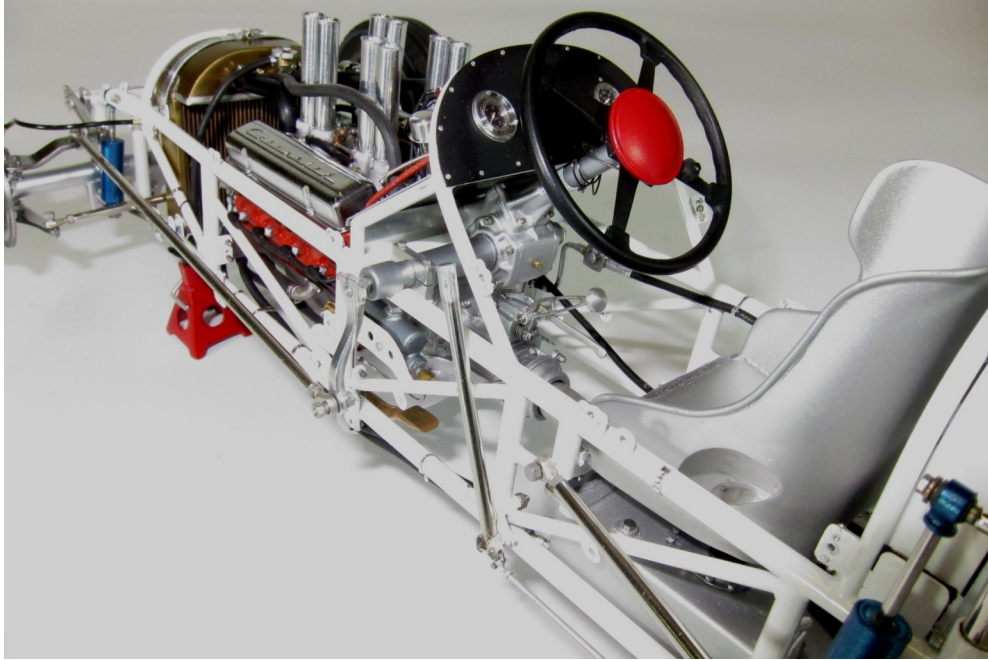
With the frame painted, assembly of the chassis could begin. Since all the other components were already fabricated, test-fit, and then painted, the assembly process itself went quickly and smoothly. I find it to be a huge advantage to pre-assemble all the components (including the various lines and hoses) before painting them, as adjustments are much easier to make when the parts are unpainted. Here are some photos of the chassis during and after assembly.

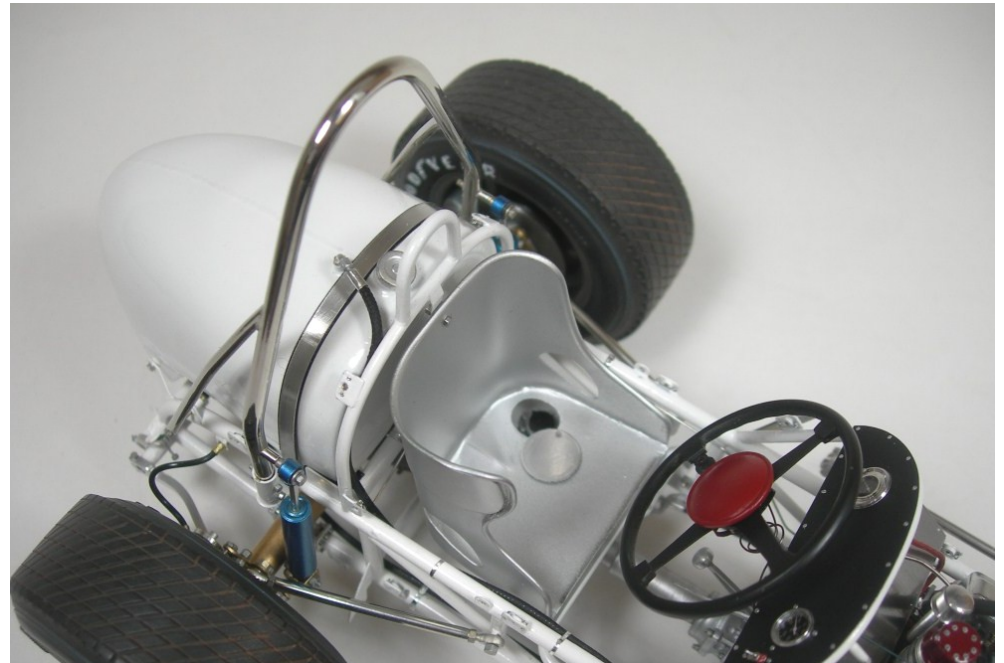
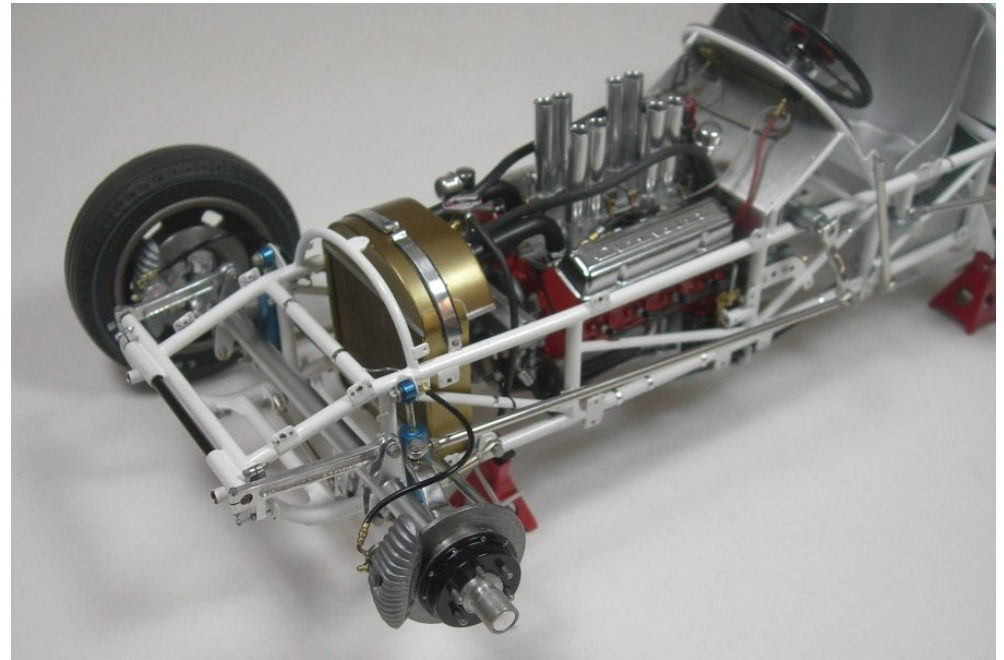
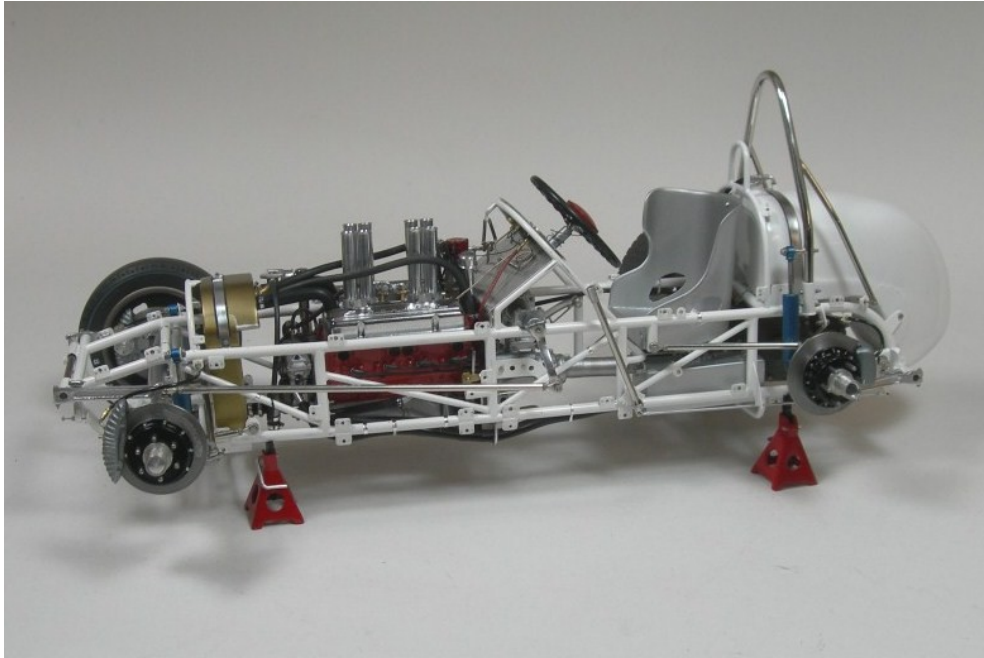


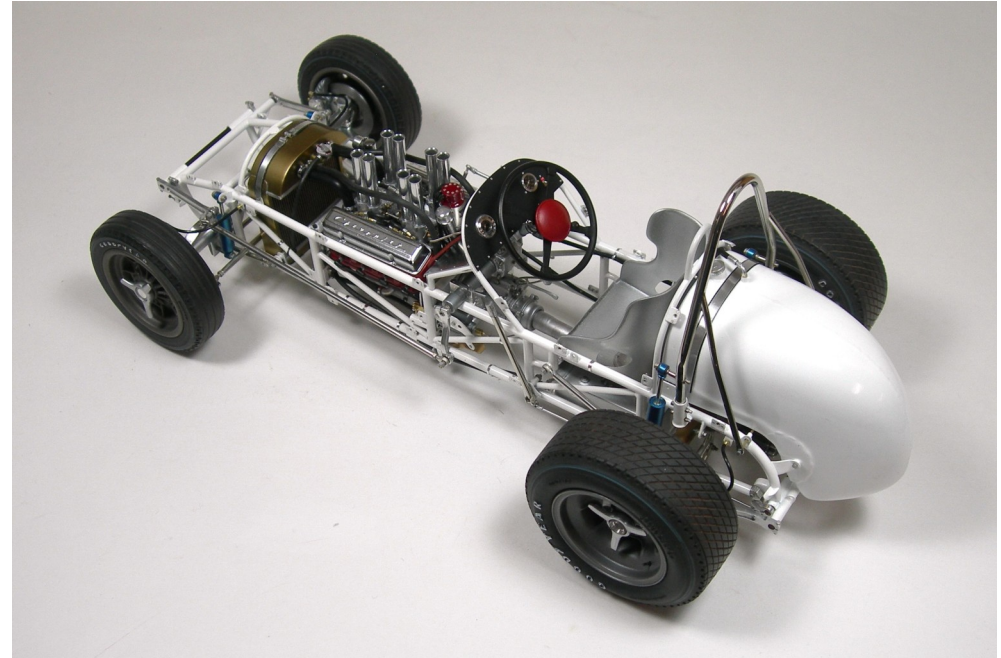


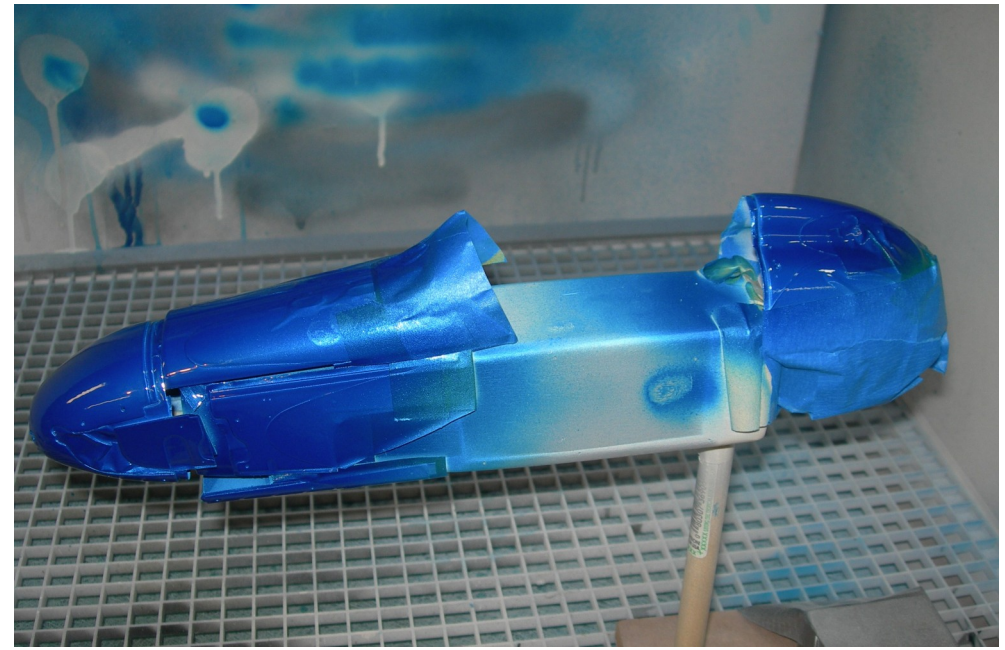




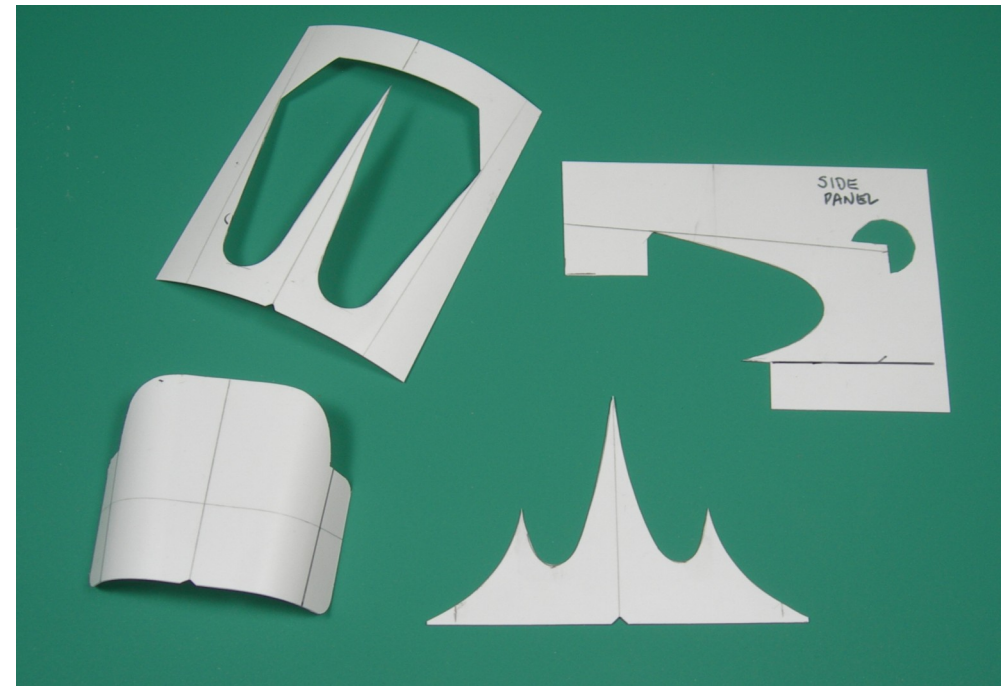


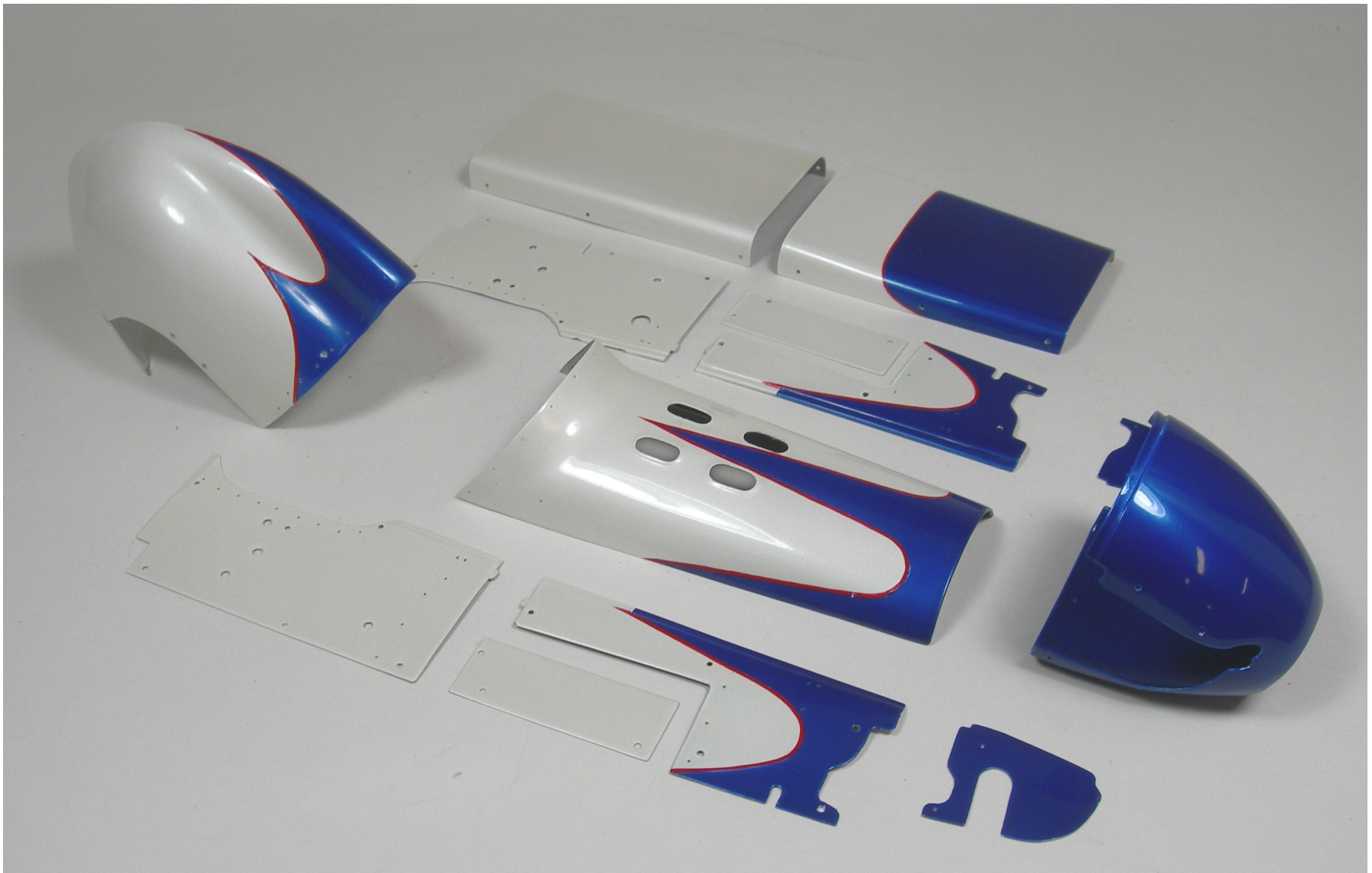






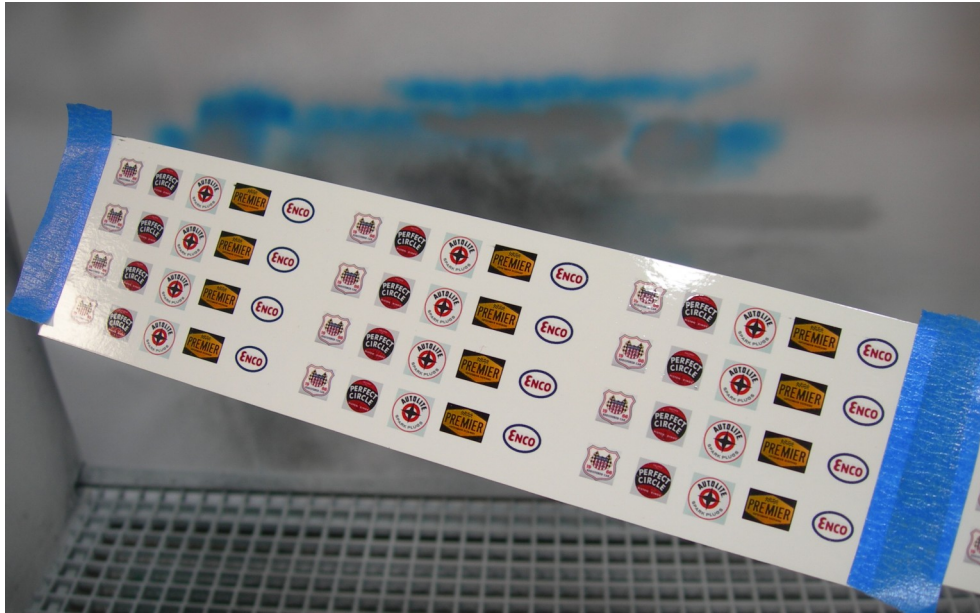
It was now time to paint the bodywork. I built a paint stand to hold the separate panels in the correct alignment and orientation so the paint uniformity could be easily managed. A sturdy paint stand also provides great peace of mind, as the last thing you need is a freshly painted part to fall on the floor and get ruined. The paint process started with metal etching primer, followed by a white lacquer base coat. I then masked off the areas to be painted blue and applied Testors White Lightning Pearl paint to the rest. Once this had a chance to dry, I unmasked the blue areas, and re-masked the pearl white and applied a metallic blue base coat for the blue scallops. I then applied Tamiya Clear Blue over the blue basecoat to achieve the candy blue finish. The purpose of this "double masking" technique was to prevent a large transition from the blue to the white, as I did not have the luxury of burying the color separation lines under a clear coat. I used no clear coat to stay consistent with the finish on the original car from the '60's. Masking templates were made from 0.015" styrene to ensure consistency of the color separation lines.





After the blue was dry, I polished the finish with a Micro-mesh polishing system and applied Meguiar's Mirror Glaze. I then hand painted the red pin stripes using Tamiya Acrylic Red, again to keep true to the original, as it featured hand-painted stripes with their typical "inconsistencies" that gave them a unique character. In this day of the computer-generated, laser-printed graphics used on race cars, it is easy to forget how variable the hand-painted markings were 50 years ago (see photo of actual car on the right).



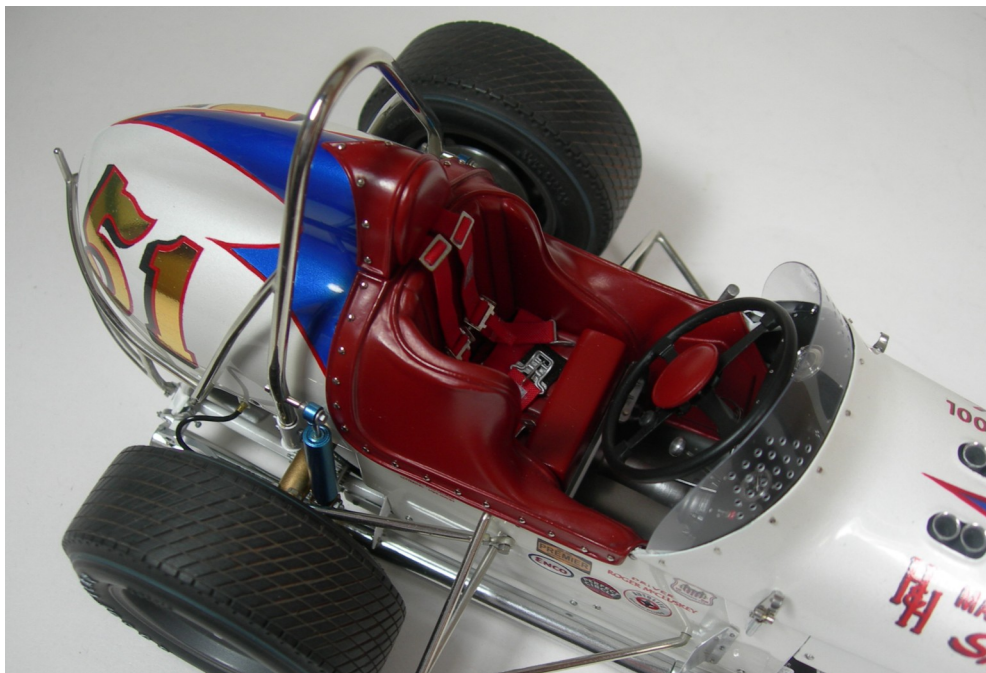


The various markings for the car were made using two methods. The sponsor stickers on the sides were photo-reduced from photographs and then printed on white EXPERTS-CHOICE decal paper using an ink-jet printer. The artwork for the driver credits, H&H lettering, and the 51's was drawn by hand, scanned, then manipulated using Microsoft Publisher and Paint before printing. These markings were converted into rub-on transfers using the Decal Pro fx system, as I did not want any clear decal film to show, again keeping true to the original's hand-painted markings. This system also offered a gold foil, which allowed me to reproduce the gold leaf centers of the 51's.





So with the final application of the numbers and markings, the five-year project was completed. It was a great challenge to scratch-build this replica, and I definitely met my goal of learning something new on every project! As with any project of this magnitude, there were times of great satisfaction, as well as times of great frustration, but perseverance paid off as always. If there is one regret, it would be that I could not finish the car sooner, as Mr. Anderson passed away 10 months before it was completed, so he never got to see the finished car, but I hope he would approve of the results.



Thanks for following along as this project came together!



On May 1, 2011 the model was recognized with six awards at the 23rd Greater Salt Lake International Scale Vehicle Championship, including "Best of Show."